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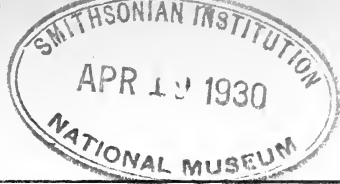
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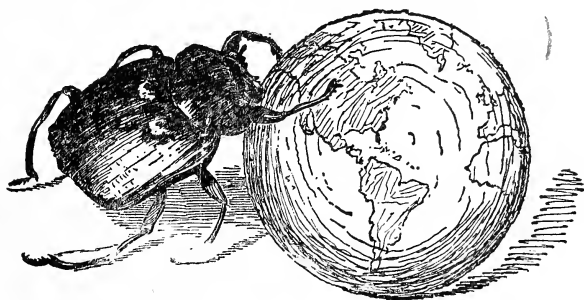
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JOURNAL

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VOL. XXXVIII

MARCH, 1930

No. 1

HOW MANY SPECIES OF TRICHOGRAMMA OCCUR IN NORTH AMERICA?

BY ALVAH PETERSON
OHIO STATE UNIVERSITY

The chief object of this paper is to call attention to the fact that biological evidence exists which seems to prove that two or more common species of *Trichogramma* occur in North America. During recent years several investigators have expressed the opinion that all of the described species of *Trichogramma* belong to one species. The author entertained this opinion until the following observations were made.

For several years he has conducted investigations with the so-called common *Trichogramma minutum* Riley as an egg parasite of the oriental peach moth, *Laspeyresia molesta* Busck, and the codling moth, *Carcocapsa pomonella* Linne. During the late fall of 1927 at Moorestown, New Jersey, it was noted that the color of the females, particularly the color of the thorax and abdomen, changed from a light lemon-yellow color (Plate 2, H) to a dark metallic or dingy olivaceous-brown (Plate 2, I). Again in the spring of 1928 the spring brood females and many of the first brood females were dark in color; however, the succeeding generations during the entire summer produced light lemon-yellow females. In the fall of 1928 the yellow females emerging late in October and thereafter changed again to a dark color. The color change in females also took place at Columbus, Ohio, in the fall of 1929 among native *Trichogramma* collected by Mr. J. R. Stear at Chambersburg, Penna., and Mr. W. P. Flint, at Urbana, Illinois, and sent to the author.

It has been interesting to note that this change in color may be brought about by subjecting the parasitized host eggs to the necessary temperature conditions. This appears to be true, particularly of specimens collected or reared early in the fall. No study has been made to determine the critical temperatures nor the period in the life of the parasite when it is most susceptible to change. Some of the following observations have been made which may throw some light on this problem. If eggs parasitized by yellow females are kept continuously in a warm room (70 degrees F.), they will produce yellow females for an indefinite period, while eggs parasitized by yellow females and subjected to average daily temperatures of 55 to 62 degrees F., or lower, and also to some night temperatures approximating 34 degrees F., or lower, they will produce dark colored females. During the fall of 1929 the author alternated the color of the succeeding generations by subjecting them to the above temperature conditions. Also, differences in color were brought about in the progeny of a given yellow female by subjecting some of the eggs to room temperature and others to low temperatures. During the summer period refrigeration may or may not produce a change in color. In some of the tests where parasitized eggs were placed in a refrigerator immediately after they were parasitized and kept at a temperature below 40 degrees F. most of the females were dark in color.

In May, 1928, it was noted that some of the field collected parasitized oriental peach moth eggs produced females that were distinctly olivaceous-brown in color (Plate 2, I) and closely resembled the dark colored females of the yellow species found late in the fall. These dark colored females were separated from the yellow forms and reared in oriental peach moth eggs. They continued to produce dark females in all succeeding generations during the summer of 1928. Only an occasional collection of parasitized eggs from one orchard produced dark colored females during 1928 while in 1927 no dark colored females had been collected or observed during the summer. In all other collections of field parasitized eggs from many orchards the females that emerged were always yellow.

This unusual appearance of dark colored females during warm weather aroused our curiosity and made us suspect that it might be another species, consequently a series of tests were started to determine this point. A number (50 or more) of cross-breeding tests were conducted between the opposite sexes of the yellow and dark colored forms. Various combinations were tried; single pairs, one female with several males, and many females with many males. In every case where the sexes were from opposite sources no successful copulation was noted and the progeny was always males. Among males and females from a given source copulation occurred readily and the progeny was usually two-thirds females. The author and other investigators have shown that unfertilized females produce males only (arrhenotokous). These results strongly support the statement that there are two species of *Trichogramma* in New Jersey.

Further evidence which supports the conclusion that there are two species of *Trichogramma* is the time required to complete a life cycle (egg to adult) of each form under similar conditions. During 1928 from May until late in the fall a careful record was kept of the time required to complete the life cycle of the two daily lots, 25 to 200 individuals of the two forms or species. These studies were conducted in an open screened insectary at Moorestown, New Jersey, and the two lots of parasitized oriental peach moth eggs were kept under identical conditions (side by side in the same container). The details of the methods employed are discussed in a paper¹ now in the hands of the editor of the *Journal of Agricultural Research* at Washington, D. C. Plate 1 shows conclusively that the average life cycle, of daily lots, of individuals arising from eggs parasitized by dark (D.D.) colored (during the summer) females was a fraction of a day to several days longer than the average life cycle of similar daily lots of individuals arising from eggs parasitized by yellow females (D.Y.). Also from May 25 to October 15 the dark colored females produced ten generations and the yellow females produced eleven generations. It will be noted that the average temperatures occurring during 1928 have been omitted in Plate 1. These are shown in another paper.¹

Another point of difference in the two forms occurs in their habit of flight. It has been repeatedly noted that the adults of the yellow form may be placed on a piece of paper or upon any open surface and at once they will crawl toward a strong light; however, they will seldom fly or jump any distance. Also, they do not fly readily when they are disturbed or touched with some object. The dark summer form or species, however, has a strong tendency to fly toward the light especially if the adults are disturbed or touched with an object.

Difference in size is not a good character to distinguish the two forms because this is subject to decided variation. Size is determined largely by the amount of food the developing individual has access to in the host egg. For example, an adult produced in egg of the angoumois grain moth, *Sitotroga cerealella* Olivier, is approximately one half as large as an adult produced in the egg (one per egg) of the codling moth, *Carpocapsa pomonella*, or in the egg of a bag worm, *Thyridopteryx ephemeraformis* Haworth.

During the winter of 1928 a careful comparative study was made of the external morphology of the males and females in order to find some good character which might distinguish the two forms or species. Plate 2 shows some of the characters of the wings, genitalia, antennæ and other parts. So far the author has been unable to find any morphological difference in the same sexes of the two forms or species. The characters figured are common to the same or opposite sexes of both forms or species unless stated otherwise in the explanation of the figures. The males resemble each other in color and structure throughout the season while the females resemble each other in structure only, since they differ in color during the summer and again resemble each other in color during late fall and early spring. It appears that we may have in these two forms another instance where morphologically species are alike yet they are distinct for they will not interbreed. Also in this case they differ in their period of development and in their flying habits.

During the summer of 1929 the author continued these studies at Columbus, Ohio. A general questionnaire was sent to several entomologists in the United States and Canada who were

interested in *Trichogramma*. The questions requested information on the color and habits of the *Trichogramma* they were investigating. In most every case the response to the questions was generous and also ample living material was sent for examination. It was interesting to note that most of the material received during August produced dark colored females. After further inquiry into the original source of the material it was learned that in most northern points of the United States where dark colored females were being reared or were being produced in numbers for liberation, the original stock came from California or Louisiana. Upon requesting investigators in these places to send living specimens, of native species uncontaminated by shipped in or liberated stock, it was noted that the females were lemon-yellow in color. The information to date indicates that the form or species possessing yellow females during the summer is more common in the north than the form of species possessing dark colored females during the summer. If this proves to be true then we might question the advisability of rearing and using for liberation in northern states a southern form or species which may not be acclimated to northern conditions.

No attempt will be made in this publication to ascertain the correct scientific names for the forms or species under discussion. At the present time living material is being assembled from various sections of North America for the purpose of learning more about the habits and morphology of the species. Perhaps in the future an attempt will be made to straighten out the tangle in the nomenclature that exists, provided some other investigator, better qualified than the author for this sort of work, has not produced a satisfactory solution to the problem in the meantime.

At the present time the author believes we have at least two species in North America even though no morphological differences have been observed. The chief visual difference seems to be in the color of the females during the summer. This color difference may be quite significant, for an examination of the original descriptions of the two species of *Trichogramma* described by C. V. Riley reveals the fact that in the description of *Trichogramma minuta*² the following statements occur: "little

dark colored four winged flies" and "it is inconspicuously marked, the body being dark brown with antennæ and legs pale and the wings iridescent"; also in the description of *Trichogramma pretiosa*,³ he says: "yellow, the eyes red, the wings hyaline," also, "differs from *Trichogramma minuta* in its smaller size, and uniform pale yellow color." Offhand it appears that Riley may have had the same species in Missouri as the author observed in New Jersey; however, it should be noted that Riley's *Trichogramma minuta* material was collected in the fall and it is possible that he may have had the dark colored individuals of the yellow species. For the sake of convenience the author suggests that Riley's original specific names may be used to distinguish the two species discussed in this paper until some investigator makes a thorough study of all species of *Trichogramma* in North America and elsewhere and gives us an authentic decision on the nomenclature.

SUMMARY

Biological evidence seems to prove that there are at least two distinct species of *Trichogramma* in North America. Morphologically they are alike; however, during the summer the females of one species are distinctly lemon-yellow in color, while the females of another are dark colored (olivaceous-brown), particularly the abdomen and thorax. The two forms will not interbreed. Also there is a constant difference in the time required for development and in their flight habits. The yellow female species appears to be more common in the north than the dark colored (summer form) females species.

ACKNOWLEDGMENTS

The author is indebted to a number of investigators for aid in this investigation, particularly for specimens and answers to questions. He wishes to extend thanks to Messrs. G. J. Haeussler, W. P. Flint, D. W. Jones, Herbert Spencer, W. E. Hinds, S. E. Flanders, J. R. Stear, A. B. Baird and others.

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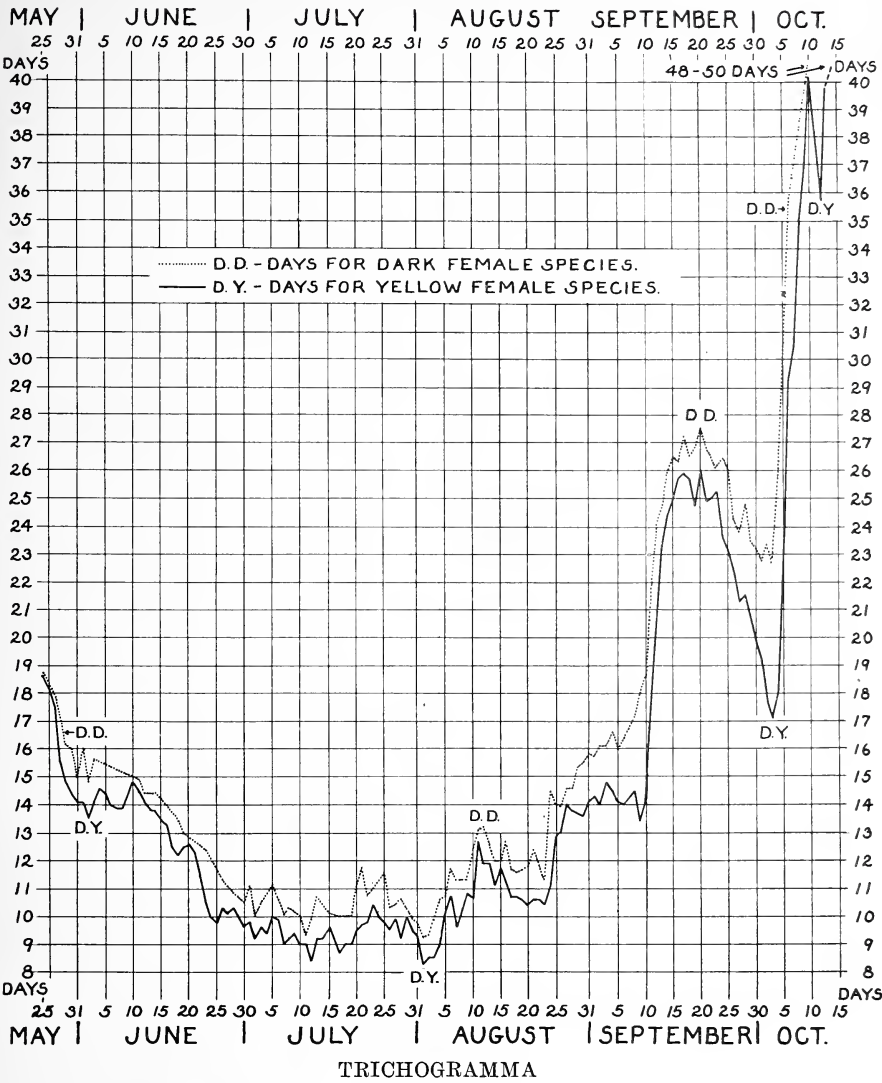
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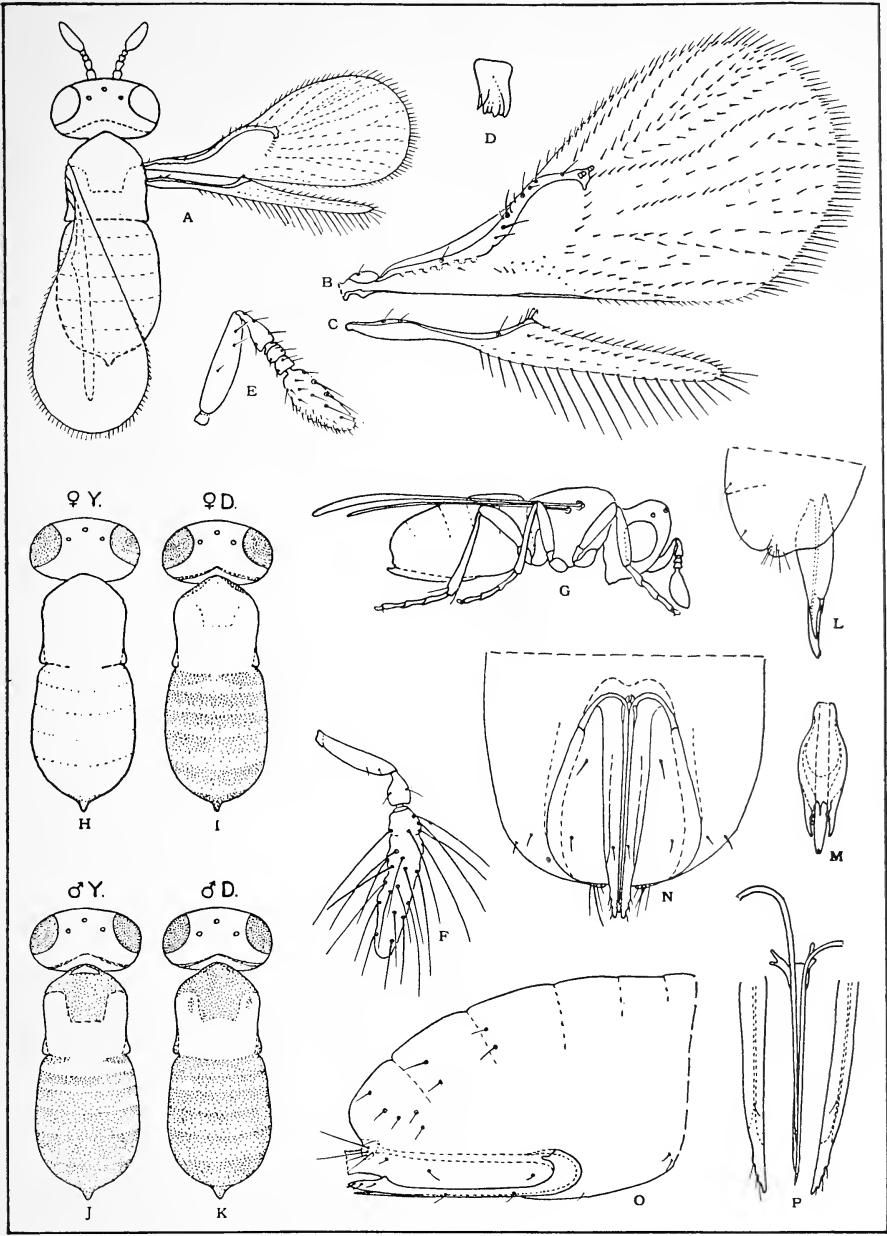
PLATES I AND II

PLATE 1. The plotted curves show the average number of days required to complete the life cycle of daily lots (25 to 200 individuals per day) of two kinds (species) of *Trichogramma* reared in eggs of the oriental peach moth during 1928 at Moorestown, New Jersey. The solid line represents the life cycle periods of the species possessing yellow females during warm weather and the dotted line represents the life cycle periods of the species possessing dark colored females during the summer.

PLATE 2. Outline drawings showing some of the external morphological characteristics common to both species unless stated otherwise.

- A. dorsal view of a female
- B. mesothoracic wing of an adult
- C. metathoracic wing of an adult
- D. mandible of an adult
- E. antenna of a female
- F. antenna of a male
- G. lateral view of a female
- H to K. color pattern; eyes red, light areas yellow (Y), stippled areas on thorax and abdomen olivaceous brown (D)
- H. color pattern of yellow female (♀ Y) species
- I. Color pattern (in summer) of dark female (♀ D) species, also of late fall and early spring females of yellow species
- J. color pattern of male (♂ Y), of yellow female species
- K. color pattern of male (♂ D), of dark female species (in summer)
- L. lateral view of male genitalia
- M. ventral view of male genitalia
- N. ventral view of female genitalia
- O. lateral view of female genitalia
- P. parts of female genitalia.





TRICHOGRAMMA

ANTHIDIINE BEES FROM OREGON WITH A DESCRIPTION OF A NEW SPECIES

BY HERBERT F. SCHWARZ

Through the kindness of Professor H. A. Scullen of Oregon State Agricultural College I have been privileged to examine a collection of Anthidiine bees which he made in Oregon during the summer of 1929. All of the bees reported upon in this paper with one exception (a specimen of *Anthidium sayi* from Idaho) were represented in Professor Scullen's catch, which is of special value because he has not confined the data on his labels to localities and dates but has included the elevations and in many instances also floral records. Several of the species noted have not hitherto been reported from Oregon.

Anthidium nebrascense Swenk

Anthidium nebrascense has previously been reported from California (Swenk, 1915; Cockerell, 1924) and from British Columbia (Schwarz, Sept., 1928). It is not surprising, therefore, to find it likewise in Oregon. Three specimens, 2 ♂♂, 1 ♀, were taken at Wallowa Lake, July 27, 1929, at elevations ranging from 4500 to 5500 feet, while visiting *Holodiscus discolor*. The males conform in general with the specifications for that sex of *nebrascense*, but the female departs rather decisively from the description of the allotype from Wyoming. Its assignment to *nebrascense* may be justified by the distinctive maculation of the legs and by the absence of inner maculations on tergite 1, which has merely a spot at each lateral extremity with a broad intervening immaculate area. At variance with Swenk's description, the clypeus is wholly black although the oval spots on the sides of the face are present. The mandibles, maculated in the allotype, are black in the Oregon female, which furthermore differentiates itself through its immaculate scutellum and femora.¹ The structural characters and the color of the hairs accord with those of the description, and the present specimen, notwithstand-

¹ Immaculate femora were noted in a female from British Columbia reported upon in 1928.

ing its restricted facial maculations, is doubtless to be viewed not as a valid variety but as an aberration. One of the males has a strong maculation on each tubercle, the other male lacks such a mark. The female is intermediate in this respect between the males, her tubercles being maculated, but only faintly. The maculations on her tergite 6 resemble a butterfly with wings spread. A similar figure occurs on tergite 6 of the female of *Anthidium collectum* (= *A. angelarum*), the subdivision into an upper and lower wing being effected by a hair-fine line of black, which probably has affinity with the threadlike dark lines that occur on the otherwise largely yellow tergite 6 of the female of *Anthidium mormonum* (= *blanditum*).

Anthidium brachyurum Cockerell and *Anthidium jocosum*
Cresson

In a fairly large series of *Anthidium brachyurum* collected at various localities in Oregon (Grant County, Aug. 12, 1929, at 3000 feet, on *Melilotus alba*; Corvallis, July 4, 1929, in part on *Trifolium repens*; La Grande, July 20, 1929, in part on *Medicago sativa*; 5 miles east of Minam, July 21, 1929, at 2700 feet elevation; Baker, July 30, 1929, at 3400 feet; Lostine, July 28, 1929, at 3360 feet) about half of the males have either the tubercles or the posterior margin of the scutellum, or both, faintly maculated. These intergrading specimens, therefore, share some of the maculations that characterize *jocosum* and tend to render still more tenuous the distinctions that have been proposed to separate *brachyurum* from *jocosum*.

Anthidium sculleni, new species

♂. Head with the proportions and sculpturing of *tenuifloræ*. The apical margin of the clypeus with a wide curvilinear emargination at its middle, and three sub-toothlike serrations on each side. The clypeus cream-colored except for a narrow rimming of black on the apical margin (two linear spots at the base in the paratype). Cream-colored cuneiform lateral face marks fill the space between the clypeus and the inner margin of the eye and end barely above the base of the clypeus, just below the antennal sockets. The mandibles are cream-colored except for the black teeth, the basal prominences, and a narrow lateral margin of black. A small, round, cream-colored spot above each eye. The eyes steel gray with black mottling. The head densely and rather rugosely punctated, the punctures being smaller and more crowded in the region between the ocelli and the base of the antennæ.

The mesonotum, mesopleura, and scutellum with sculpturing similar to that of the head. The base of the propodeum with a band of indistinct punctures but the apical portion of the V-shaped enclosure devoid of punctures and polished. The tubercles with a cream-colored spot (faint in the paratype); the tegulae broadly cream-colored in front, more narrowly behind; the hind margin of the scutellum with a narrow cream-colored band, broadly interrupted in the middle. (In the paratype maculations on the scutellum are lacking, and in both type and paratype the mesonotum is immaculate.)

The legs black, the base of all the tibiae with an abbreviated pale stripe, a supplementary stripe toward the apex of the front pair, and a subquadrangular spot at the apex of the middle pair (absent in the paratype). All of the basitarsi externally cream-colored.

The sculpturing of the abdomen much finer than that of the head and thorax, with resulting shininess. The apical rim of tergites 1-6 with rather dense, uniform, and minute puncturing compared to the sparser, more irregular, on the whole coarser and less distinct punctation on the basal portion of each tergite, but the basal portion is the more shiny. The pygidium shiny notwithstanding its rather coarse sculpturing. [The character of the pygidium and of the apical sternite is indicated in the discussion that follows this description.] The maculations on the tergites, like those of the other parts, cream-colored. Tergite 1 four-spotted, the outer spots subtriangular and relatively large compared with the small transversely linear inner spots. The bands on tergites 2-5 (in the paratype only on tergites 2-4) with a narrow median interruption, the interruption being progressively less from tergite to tergite. The lateral halves of the bands widely and subquadrangularly emarginate above, the inner element of each lateral half rather clavate, the outer subquadrangular. The outer elements of the bands on tergites 1-4 more developed than the inner; on tergite 5 this condition is reversed; on tergite 6 only the inner elements survive in the form of two comma-shaped maculations. The lateral halves of the band on tergite 2 with a tendency to subdivide; in the type this subdivision is complete, in the paratype incomplete. In both specimens the lateral spines on tergite 6 are straight.

The hair of head, thorax, legs, and dorsum of abdomen prevaillingly whitish to silvery gray, except for the usual golden to copper hairs on the under side of the tarsi and a faintly ochraceous tinge on the vertex. The hair on the venter partly gray but intermixed are hairs of darker hue, giving a brownish effect.

This insect is in size and general aspect rather deceptively like *tenuifloræ*. The structure of its pygidium and of the process on the apical sternite separates it, however, from *tenuifloræ*, even when allowance is made for the rather variable character of the pygidium in *tenuifloræ*. In the type specimen the lateral lobes of the pygidium are relatively wide basally but much narrowed apically, being a little suggestive of those of *collectum* although

shorter and not straight-sided, a little more angular. Indeed the curvilinear inner apical contour (if the central spine be eliminated from consideration) gives the pygidium, as in *aridum*, somewhat the appearance of a half-moon though the crescentic shape is not so perfect as in the pygidium of *palliventre* (= *californicum*). The process on the apical sternite is again much like that of *aridum*. In *tenuifloræ* the lateral members of this structure, while in general of triangular shape, are elongated finger-like or spine-like at the apex and end on a level with the middle member. On the other hand, in the species here described the lateral members are distinctly triangular in form, without apical elongation, and end on a level distinctly below that of the middle member. This is true of the process on the last sternite of both type and paratype. The pygidium of the paratype, on the other hand, differs a little from that of the type, the lateral elements being somewhat broader and rather more angulated in the paratype than in the type.

The type was taken at Wallowa Lake, on the Aneroid Lake Trail, at an elevation of from 5000 to 6000 feet, on July 22, 1929. The paratype is from the Blue Mountains, in the northeastern part of the state, having been caught on Anthony-Dutchflat Trail, 7100-7850 feet, on Aug. 8, 1929.

From the same locality as the type and taken on the same day, although at a higher elevation (6400 feet), is a female which is not separable from *tenuifloræ*. Nevertheless, I am inclined to believe that it is the female of *sculleni* and that in this sex *tenuifloræ* and *sculleni* may be indistinguishable. Cockerell in describing *tenuifloræ* noted that the abdominal bands of the female were slightly interrupted medianly and he again alluded to this character (Sept. 5, 1925) in discussing the Pacific Coast representatives of *tenuifloræ*. This is the condition also in the putative female of *sculleni*, although in Rocky Mountains specimens of what I have included in *tenuifloræ* the two halves of the band not infrequently coalesce.

In his paper on the Anthidiine Bees in the Collection of the California Academy of Sciences (Sept. 5, 1925) Cockerell provides a key (p. 359) for males having the "abdominal bands whitish or very pale." Of these the description of *hamatum*

applies more nearly than do the others to the insect under discussion. There are, however, the following differences: the male specimens of *sculleni* are about 10 mm. in length not "about or nearly 13" as indicated for *hamatum*; there is in the specimens of *sculleni* no "spot at end of scape." While the relative narrowness of the lateral lobes of the pygidium may be much the same in *hamatum* and *sculleni*, the lobes are not obtuse in *sculleni* but instead slightly angular. The presence of brownish hairs on the venter may also be cited as a distinguishing character of *sculleni*. Great reliance cannot, however, be placed on the color of the hairs, for in other species of the Anthidiinæ it has been found that considerable variability in this respect may be found in a single series.

Dianthidium sayi Cockerell

Dianthidium sayi is a species of wide distribution, having been recorded from Missouri, Nebraska, Kansas, Colorado, Utah, Montana, and Alberta. It has not hitherto been reported—so far as I am aware—from any of the Pacific Coast states. Its occurrence in Oregon is, therefore, of interest. There is a large series from Ontario, Oregon, near the border of Idaho, that was collected August 1, 1929, at an elevation of 2155 feet. Some of the specimens in this series were taken on *Grindelia nana*. In addition to Oregon yet another state, Idaho, can be added to the known range of *sayi*, for in the material kindly supplied by Professor Scullen is a specimen collected by J. F. Bock at Parma, Idaho, on July 16, 1929.

Dianthidium pudicum Cresson

As *Dianthidium pudicum* has been recorded from the neighboring states of Washington and California, and from near-by Montana, it occasions no surprise to find it represented also in Oregon. Several females were collected at Hereford, Aug. 10, 1929, at an elevation of 3660 feet, and a single male at Wallowa Lake, July 27, 1929, at an elevation of from 4500 to 5500 feet. One of the females is exceptional in having abdominal tergites 2-4 four-spotted. The male, like some specimens of *pudicum* var. *provancheri* from Riverside, California, previously reported upon (Schwarz, Dec. 1928), has the hind tibiæ completely maculated externally.

Dianthidium subparvum Swenk

This species, described from Washington (type) and British Columbia (allotype), occurs also in Oregon, being represented in the collection here reported upon by a single female taken at Wallowa Lake on the Aneroid Lake Trail, 5000 to 6000 feet, July 24, 1929. Like some of the specimens reported upon (Sept., 1928) from Canada it is not stabilized in its maculations, offering in this respect an intergrading condition between *subparvum* as described by Swenk and true *parvum*. The present specimen aligns itself with *subparvum* in respect to its immaculate scutellum; with *parvum*, however, in respect to the maculation on each side of the anterior margin of the mesonotum.

Anthidiellum robertsoni Cockerell

Cockerell, 1925, in reporting *robertsoni* from Colestin, Jackson County, near the southern boundary of the state, expressed surprise "to find it extending its range to Oregon." The range is, however, still further north into Oregon, for in the material here reported upon are several specimens from Baker County in the northeastern part of the state. The localities in Baker County are as follows:—

Hereford, 3660 feet elevation, Aug. 10, 1929; Baker, 3450 feet elevation, Aug. 10, 1929.

A. robertsoni is also represented in Crook County in the center of the state, having been taken ten miles west of Prineville, Oregon, 3100 feet elevation, Aug. 13, 1929.

In several of the males the inverted T-shaped figure on tergite 6 is more or less distorted or reduced to fragments by an expansion of the surrounding yellow area.

STUDIES IN AMERICAN SPIDERS: GENERA
CERATINOPSIS, CERATINOPSISIDIS AND
TUTAIBO

BY SHERMAN C. BISHOP AND C. R. CROSBY

CERATINOPSIS Emerton

Emerton, Conn. Acad. Sci. Trans. 6: 36, 1882. Type not indicated.

Simon, Hist. Nat. Ar. 1: 673, 1894. Designated *Erigone interpretres* Cambr. as type.

Notionella Banks, Am. Nat. 39: 312. 1905. Type, "*Ceratinopsis interpretres*."

In this genus the embolic division is of the spiral type with a long tail-piece as in *Ceraticelus*. The terminal part of the embolic division, or embolus proper, arises from the middle part as a distinct break as in that genus. The abdomen has the integument soft and without hardened plates.

Ceratinopsis anglicana Hentz

(Figures 1-4)

Theridion anglicanum Hentz, Boston Soc. Nat. Hist. Jour. 6: 275, pl. 9, fig. 6. 1850; Burgess Ed. p. 146, pl. 16, fig. 6, 1875.

Erigone purpurescens Keyserling, Spinnen Am., Therid. 2: 187, pl. 17, fig. 248. 1886. (♀ only.)

Ceratinopsis purpurescens Simon, Hist. Nat. Ar. 1: 644. 1894.

Bathyphantes anglicanum Banks, Ent. Soc. Wash. Proc. 4: 189. 1899.

Ceratinopsis anglicana Crosby, Phila. Acad. Nat. Sci. Proc. 1905. p. 316, 341.

MALE. Length, 2 mm. Cephalothorax reddish orange, lighter on the head, viewed from above broadly rounded on the sides, the sides strongly convergent towards the front, the anterior eyes in profile; viewed from the side low and gradually ascending behind, head gently arched; clypeus gently convex, nearly vertical. On the top of the head there is a long stiff hair directed forward. Just below the anterior median eyes there is a stout hair curved upward. Across the median ocular area there is a row of eight stiff erect hairs longest in the middle and decreasing in length toward each side.

A short stiff hair curved forward between the posterior median and lateral eyes.

Posterior eyes in a gently procurved line, the median separated by twice the diameter. Anterior eyes in a very slightly procurved line, the median separated by the radius and from the lateral by a little more than the diameter.

Clypeus wider than the median ocular area. Chelicerae, endites, sternum and labium reddish orange. Hind coxæ separated by the length. Legs with coxæ and basal half of femora reddish orange, the remainder darker. Abdomen reddish orange to purplish. Many specimens fade to dusky orange yellow.

Femur of palpus nearly straight. Ratio of length of femur to that of patella as 10 to 4. Tibia short and broad, when viewed from above the anterior margin broadly excavated, the anterior lateral angle produced into a broad process which when viewed from the dorso-lateral aspect is armed with three broad blunt teeth. The cymbium with a distinct curved ridge opposite the paracymbium. Paracymbium broad at base, abruptly narrowed, the tip slender. The tail-piece of the embolic division broad at base, then constricted and enlarged at tip. The middle part of the embolic division heavy, produced with a sharp point beyond the break, shining black. The embolus long, slender, curved in the form of a reversed "S" and lies over the face of the bulb. The median apophysis appears as a thin blunt-pointed process lying within the curve of the middle part of the embolic division and is overlaid by another process which seems to be attached to the tegulum by a membrane. This latter process is basally broad and terminates in a black blunt beak-shaped tooth. Bezel rather low with the edge evenly rounded.

FEMALE. Length, 2.5 mm. Similar to male in color but in fresh specimens the abdomen is a more brilliant red. Tarsus of palpus nearly black.

Posterior eyes in a slightly procurved line, the median a little larger than the lateral, separated by the diameter and from the lateral by a little less. Anterior eyes in a nearly straight line, the median nearly touching, separated from the lateral by a little more than the diameter. Epigynum has the middle lobe narrow in front and dilated in the middle, the posterior transverse arms narrow. Abdomen purplish red.

Type locality: Alabama.

South Carolina: Nichols, Oct. 21, 1926, 1 ♀.

North Carolina: Jacksonville, Oct. 23, 1928, 1 ♂.

Georgia: Bainbridge, 2 ♀ (Bradley).

Mississippi: Ocean Springs, Jan., 2 ♂, 3 ♀ (J. H. Comstock).

Florida: Wewahitchka, Dead Lake, Apr. 6, 1927, 1 ♂, 1 ♀; Lake Bradford, Leon Co., Apr. 13, 1927, 1 ♀; Rock Bluff, Apr. 4, 1927, 1 ♀.

Louisiana: Jennings, 1 ♂; Baton Rouge, March 20, 1903, 4 ♀ (J. H. Comstock); without locality, 1 ♀ (Gilbeau).

Texas: Victoria, Aug., 1905, 1 ♂, 2 ♀ (J. D. Mitchell); Oct., 1904, 3 ♀.

Cuba: Cerro Cabras, Sept. 11, 1913, 1 ♀.

In one female from Victoria, Texas, the terminal part of the embolus which had been broken off at the bend, is retained in the epigynum. The base of the broken part lies laterally from the receptacle and the tip projects from the central fovea.

***Ceratinopsis atolma* Chamberlin**

(Figures 5-7)

Ceratinopsis atolma Chamberlin, Calif. Acad. Sci. Proc. (Ser. 4) 14: 110, figs. 11, 12. 1925.

MALE. Length, 1.5 mm. Cephalothorax dusky orange, head darker; viewed from above rather broad, evenly rounded on the sides, slightly convergent towards the front, evenly rounded across the front; viewed from the side, steeply ascending to the dorsal groove, then gradually ascending in a straight line to the posterior eyes. Head rather high and narrow. Clypeus straight and vertical.

Posterior eyes in a straight line, equal, equidistant, separated by the diameter. Anterior eyes in a straight line, the median a little smaller than the lateral, separated by the diameter, a little closer to the lateral. Clypeus nearly twice as wide as the median ocular area. Sternum nearly smooth, dusky orange, darker at margin, rather wide, convex, convergent behind produced as a truncate point between the hind coxæ which are separated by a little more than the length. Labium and endites dusky orange. Legs and palpi orange yellow. Chelicerae dusky orange yellow. Abdomen dirty grayish white.

Femur short and rather thick. Patella rather short, strongly arched above. Tibia longer than patella, produced dorsally into a broad process which is bluntly and broadly rounded at tip. On the mesal side of this process there is a large triangular lobe, below which there is a deep rounded notch. The paracymbium is rather small and slender and lies close to the edge of the cymbium. The bezel long and slender, rounded at base and narrowed to a point at the opposite end. Tail-piece of the embolic division very long, strongly curved, the tip lying in a notch at the base of the cymbium. The terminal part of the embolus emerges from a notch in the edge of the bezel as a shining, black rod and curves around to the edge of the cymbium where it ends in a blunt point. The duct crosses the embolus just before the end

and is reinforced with a black support and makes a wide curve so that the tip lies just inside the edge of the bezel.

Tennessee: Springfield, July, 1 ♂. Type.

***Ceratinopsis auriculata* Emerton**

(Figures 8-13)

Ceratinopsis auriculatus Emerton, Conn. Acad. Sci. Trans. 14: 185, pl. 2, fig. 9, 1909.

MALE. Length, 1.5 mm. Cephalothorax orange yellow; viewed from above rather short, broad, rounded on the sides, the sides strongly convergent towards the front; the lateral eyes being borne on tubercles are thrown into profile. Black area on head extending far back of the eyes and broadly rounded behind; clypeus black.

Eye area very wide, when viewed from above, angulate on the sides and concave in front. Cephalothorax viewed from the side rather steeply ascending to the posterior median eyes with a slight depression at the cervical groove. Clypeus in side view bluntly angulate. Sternum orange darkened with brown towards the margin. Endites lighter. Legs yellowish. Palpi yellow, tarsus black. Abdomen reddish orange.

Posterior eyes in a very slightly procurved line, the median separated by a little more than the diameter and from the lateral by three times the diameter. Anterior eyes in a recurved line, the median smaller than the lateral, separated by the diameter and from the lateral by six times the diameter.

Femur of palpus short, thick and nearly straight, curved inward at base. Patella short and thick. Ratio of length of femur to that of patella as 12 to 7. Tibia short and greatly widened distally, the dorsal margin straight with small notch on each side, mesal angle square, the lateral angle produced into a stout process which when viewed from above appears curved inward; when viewed from the side the tip is seen to be armed with 5 or 6 minute teeth. Cymbium laterally excavated at base, strongly angulate opposite the paracymbium, the edge beyond the angle thickened, provided with a broad, shallow, smooth furrow. Paracymbium long, slender, gently curved, the basal half hairy. Tail-piece of embolic division long, slender, nearly straight; the middle part makes nearly a complete turn and is continued in a sharp point beyond the break. The embolus seems to consist of a free duct which curves back along the middle part.

FEMALE. Length, 1.7 mm. The black on the head is more intense and more sharply outlined than in the male. The head is broad but not concave in front. The lateral eyes are protuberant but not so strongly as in the male.

Posterior eyes in a slightly procurved line, equal, the median separated by a little more than the diameter and from the lateral by a little more. Anterior eyes in a very slightly procurved line, the median smaller than the lat-

eral, separated by the radius and from the lateral by three times the radius. The epigynum has two large openings near the posterior margin.

Allotype ♀, McLean, N. Y., July, 1904.

Type localities: Three-mile Island, Lake Winnepesaukee, and Fitzwilliam, N. H.; McLean, N. Y.

New York: Freeville, May, 1911, 1 ♂; Ringwood, Tompkins Co., May 20, 1919, 2 ♂ (Dietrich) Emerton det.; McLean, July, 1904, 1 ♀ (allotype).

Banks (Phila. Acad. Nat. Sci. Proc. 1916, p. 72) states that his records of *C. nigriceps* in Phila. Acad. Nat. Sci. Proc. 1892, p. 33, do not refer to that species but to *C. auriculata* Em. This is probably an error for he states in the earlier paper that it is frequent in various localities near Ithaca. As a matter of fact *auriculata* is rarely found except in sphagnum bogs.

Ceratinopsis bicolor Banks

Ceratinopsis bicolor Banks, Am. Ent. Soc. Trans. 23: 67. 1896.

The types of this species in the Museum of Comparative Zoology are two recently hatched specimens that probably do not even belong to the family. The species cannot be recognized from the description. Banks states his specimens were immature.

Type locality: Ithaca, N. Y.

Ceratinopsis interpres Cambridge

(Figures 14-17)

Erigone interpres Cambridge, Zool. Soc. Lond. Proc. 1874, p. 430, pl. 55, fig. 1.

Ceratinopsis interpres Emerton, Conn. Acad. Sci. Trans. 6: 37, pl. 9, fig. 1, 1882.

Erigone interpres Keyserling, Spinn. Am. Therid. 2: 144, pl. 16, fig. 212. 1886.

Ceratinopsis interpres Emerton, Common Spiders, p. 153, figs. 377, 378. 1902.

Notionella interpres Banks, Am. Nat. 39: 312. 1905.

Ceratinopsis interpres Crosby, Phila. Acad. Nat. Sci. Proc. 1905, p. 316.

MALE. Length, 2.5 mm. Cephalothorax orange with the head black, viewed from above broad and rounded posteriorly, the sides strongly con-

vergent towards the front; head elevated and projecting forward so that the eyes are in profile. Cephalothorax viewed from the side very gently arched posteriorly with a broad gentle depression at the cervical groove, then gently arched to the posterior eyes; top of head nearly straight; median ocular area slanting forward. Clypeus concave and strongly retreating, yellow except near eyes. Sternum and endites orange yellow. Legs light yellow, not darkened distally. Abdomen yellowish white, spinnerets black.

Posterior eyes in a straight line, the median separated by the diameter and a little farther from the lateral. Anterior eyes in a slightly recurved line, the median smaller than the lateral, separated by less than the diameter and from the lateral by the diameter. A row of hairs between the median and lateral eyes on each side directed towards the middle, also a median row on top of head directed forward.

Femur of palpus distinctly thickened. Patella thick, short, rounded above. Ratio of length of femur to that of patella as 20 to 8. Tibia short and broad, the dorsal margin broadly and evenly concave, the mesal bluntly angulate, the lateral angle produced into a large divergent, black, triangular process, the extreme tip of which is strongly incurved. Cymbium with a narrow groove next to the lateral margin. Paracymbium small with a small sharp hook at tip. Tail-piece of the embolic division long, slender, gently curved, the middle part making about one half turn before the break beyond which it is extended in a sharp point, the terminal part long, very slender and curved back along the middle part.

FEMALE. Length, 2.7 mm. Resembles the male in form and color but the head is relatively wider and not so high. The epigynum consists of a large quadrate plate, rounded in front, the fovea is triangular, pointed in front, the transverse arm very narrow in a strictly ventral view. Dark brown area indicates the internal parts.

Type locality: Holyoke, Mass.

New Hampshire: Hollis, July, Aug., 1888, 1 ♂, 9 ♀ (Fox).

New York: Rock City, Cattaraugus Co., June 5, 1915, 1 ♂; Peru, June 10, 1916, 1 ♂.

Maryland: Glen Echo, Je., 1926, 2 ♀ (Fouts); Plummer's Island, June 21, 1913, 2 ♂, 5 ♀ (Shoemaker), May 18, 1913, 6 ♂ (Shoemaker); Cedar Grove, May 28, 1912, 1 ♂ (Shoemaker).

Virginia: Great Falls, June 22, 1916, 2 ♀ (Shoemaker); Opposite Plummer's Id., May 18, 1913, 2 ♂; July 19, 1913, 1 ♀ (Shoemaker); Black Pond, May 21, 1911, 1 ♂ (Shoemaker).

District of Columbia: April, 1888, 1 ♂, 5 ♀ (Fox), Oct., 1 ♂ (Fox).

North Carolina: Henderson, 1 ♀.

Kentucky: Quicksand, June 25, 1925, 3 ♀.

Missouri: Columbia, May, 1 ♂.

***Ceratinopsis labradoriensis* Emerton**

Can. Ent. 57: 66, fig. 1, 1925

Type locality: Cabot Lake, Labrador.

We have not had opportunity to study this species.

***Ceratinopsis laticeps* Emerton**

(Figures 18-21)

Ceratinopsis laticeps Emerton, Conn. Acad. Sci. Trans. 6: 37,
pl. 9, fig. 3. 1882.

Erigone calcarata Keyserling, Spinn. Am. Therid. 2: 181, pl. 17,
fig. 240. 1886.

Porrhomma calcaratum Simon, Hist. Nat. Ar. 1: 682. 1894.

MALE. Length, 1.5 mm. Cephalothorax dark reddish orange, head black, the black extending backward in a point to the dorsal furrow, clypeus black above the protuberance. Cephalothorax viewed from above evenly rounded on the sides and across the clypeus; head broad, straight across the front; viewed from the side gently arched behind and then ascending in a nearly straight line to the top of the head which is nearly level for a short distance back of the eyes. Front of head slanting steeply downward through the median ocular area to the rounded protuberance on the clypeus. Clypeus strongly convex. Lower part of median ocular area and upper part of clypeus clothed with numerous hairs directed upward. In front of posterior median eyes a few hairs directed downward and outward. Chelicerae dark reddish orange. Endites same color but crossed by curved blackish lines. Sternum rough, blackish over dark reddish orange. Legs yellowish. Palpi light orange. Abdomen light reddish over pale yellowish.

Posterior eyes in a straight line, the median smaller than the lateral, separated by one and one-half times the diameter and from the lateral by twice the diameter. Anterior eyes in a straight line, the median smaller than the lateral separated by less than the diameter and from the lateral by two and one-half times the diameter.

Femur of palpus rather short and thick, the stridulating tooth near the base on the inner side prominent. Patella short, curved downward. Ratio of length of femur to that of patella as 14 to 6. Tibia short and rather broad, the dorsal margin produced into two short triangular teeth between which there is a shallow rounded emargination, the lateral angle produced into a very large process which is armed laterally with a short blunt tooth, and anteriorly with a long black, sharp tooth. Cymbium provided with a

very narrow furrow near the edge; paracymbium with the base rather stout and hairy, the remainder rather narrow, strongly curved, sickle-shaped. Bezel low and narrow, produced toward the tip of the palpus into two distinct points of unequal length. Tail-piece of the embolic division long, slender and gently curved, the middle part curved in a half circle and produced beyond the break into a slender acute point, the terminal part curved back, following the curve of the middle part, the tip lying next to the bezel.

FEMALE. Length, 1.7 mm. Similar to the male in form and color but the head is blacker and the black extends almost to the margin of the clypeus. Head wide, not so straight across the front as in the male. Clypeus in side view not so strongly convex. In some specimens the sides of the abdomen are nearly black and occasionally there is a median black stripe. The middle lobe of the epigynum narrow, transverse, the openings well separated, and leading under the overhanging anterior part of the epigynum.

Type localities: Danvers, Mass., and New Haven, Conn.

Massachusetts: Shirley, June 18, 1917, 1 ♀.

Michigan: Eagle Harbor (Type of *calcarata*).

New York: Freeville, July, 1 ♀. Ithaca, Aug., 1 ♂; May 11, 1916, 1 ♂, 5 ♀; without date, 1 ♂ (Banks); Olcott, Feb., 1925, 1 ♂, 1 ♀, sifting leaves (Dietrich); Montauk Pt., May 24, 1924, 2 ♀; Cold Spring Harbor, July 10, 1907, 1 ♀; Oyster Bay, 1 ♀ (Chamberlin).

***Ceratinopsis nigriceps* Emerton**

(Figures 22-26)

Ceratinopsis nigriceps Emerton, Conn. Acad. Sci. Trans. 6: 37, pl. 9, fig. 2. 1882.

MALE. Length, 1.6 mm. Cephalothorax orange, head black; the black extends backward in a triangular point but not so far back as in *laticeps*. Clypeus orange. Head narrow, eyes in profile when viewed from above. Cephalothorax viewed from the side rather steeply ascending to the top of the head. Clypeus concave. Chelicerae orange. Sternum orange yellow, smooth.

Femora of legs orange yellow, the other segments dusky. Abdomen light reddish orange over yellowish. Posterior eyes in a straight line, separated by three times the radius. Anterior eyes in a slightly procurved line, equal, separated by less than the diameter.

Femur of palpus rather short and thick, nearly straight. Patella short and as thick as femur. Ratio of length of femur to that of patella as 15 to 7. Tibia short, armed with a very stout dorso-lateral apophysis which is strongly incurved. When viewed from above and in front the tip of the

apophysis appears squarely truncate. The dorsal margin of the tibia armed with a large triangular tooth separated from the apophysis by a deep rounded notch. Cymbium with the lateral groove narrow and close to the edge. Paracymbium slender and gently curved, the tip not strongly hooked. Bezel with a broad rounded notch for the reception of the middle part of the embolic spiral, the tip produced into a point and the opposite end rounded. Tail-piece of embolic division long, slender and evenly curved. After emerging at the bezel the embolus makes one turn in an open spiral before the break beyond which it is continued in a sharp point. The terminal part of the embolus is long and slender and follows in general the curve of the middle part but the tip lies outside the bezel.

FEMALE. Length, 1.6 mm. Very similar to the male in form and color but the head is not so high. The epigynum has the middle lobe narrow in front and widened behind.

Type localities: New Haven, Conn., and Dedham, Mass.

Maine: Sebasticook Lake, Aug. 24, 1925, 2 ♀.

New Hampshire: Pike, June, 1908, 1 ♀ (Hayhurst).

Massachusetts: Shirley, June 18, 1917, 1 ♂; Westfield, Sept. 2, 1925, 1 ♀.

New York: Shelving Rock Mt., Lake George, July 27, 1920, 1 ♂; Saratoga Co., June 26, 1920, 1 ♂; Tackawasick Pond, Rensselaer Co., June 25, 1920, 1 ♂; Freeville (Woodwardia swamp) Aug. 13, 1922, 4 ♀; Oakland Valley, May 26, 1920, 6 ♀; Little Pond, Orange Co., May 25, 1920, 1 ♀; Cold Spring Harbor, July 4, 1907, 1 ♂; Riverhead (Sound Beach), Sept. 10, 1922, 1 ♂.

Virginia: Maurertown, Oct. 5, 1923, 2 ♂, 1 ♀; Alberta, Oct. 27, 1923, 1 ♀.

North Carolina: Blowing Rock, Oct. 10, 1923, 2 ♂, 11 ♀.

Ceratinopsis nigripalpis Emerton

(Figures 27-28)

Ceratinopsis nigripalpis Emerton, Conn. Acad. Sci. Trans. 6: 38, pl. 9, fig. 4. 1882.

Ceratinopsis similis Banks, Am. Ent. Soc. Trans. 23: 67. 1896.

Ceratinopsis tarsalis Emerton, Psyche 31: 141, fig. 2. 1924.

MALE. Length, 1 mm. Cephalothorax orange, the head black between the eyes and backward to the dorsal groove, the radiating lines dusky. Cephalothorax viewed from above rather broad, rounded on the sides and

rounded-convergent toward the front. No constriction at the cervical groove. The eyes in profile. Cephalothorax viewed from the side gradually ascending in a nearly straight line to the eyes, clypeus strongly concave. Femur of legs yellow orange, the remaining segments nearly black. Palpi yellowish, tarsi blackish. Chelicerae and endites yellowish. Sternum orange, darker near the margin. Posterior coxae separated by the diameter. Abdomen dark gray, nearly black above, much lighter beneath.

Posterior eyes in a straight line, equidistant, the median a little smaller than the lateral and separated by a little more than the diameter. Anterior eyes in a very slightly procurved line, the median a little smaller than the lateral, equidistant, separated by the radius of the median.

Femur of palpus rather short and stout, nearly straight, patella short and stout, as thick as femur. Ratio of length of femur to that of patella as 12 to 6.

Tibia short; the dorso-lateral apophysis rather stout, when viewed from above it appears double-pointed but when viewed diagonally from the side it appears as a single straight sharp-pointed process. The dorsal margin of the tibia with a blunt rounded tooth separated from the apophysis by a deep rounded emargination. Cymbium with a narrow groove close to the margin. Paracymbium broad at base, slender toward tip. Bezel elongate, notched opposite the middle part of the embolic division and produced at tip into a point. Tail-piece of the embolic division long, slender and spirally curved, the middle part after emerging from the edge of the bezel curves outward and then back to the edge of the cymbium, produced into a blunt point beyond the break. The terminal part long and slender, curved backward across the middle part to form with it a figure eight.

FEMALE. Length, 1.3 mm. Similar to the male but the head is broader and not so high. Palpi have the femur and patella yellow, tibia and tarsus blackish. The epigynum has the middle lobe with the central part very long and slender and the transverse arms proportionally short.

Type locality of *nigripalpis*: New Haven, Conn.; of *similis*: Shreveport, La.; of *tarsalis*: Providence, R. I., Monponsett, Middleboro and Hyannis, Mass.

New York: Ithaca, 1 ♂, det. by Banks as *C. interpres*; Cold Spring Harbor, Apr. 10, 1905, 1 ♀ (Bryant); Oyster Bay, 1 ♀ (Chamberlin); Baiting Hollow, May 31, 1923, 1 ♂, 2 ♀; Riverhead, Sound Beach, Sept. 10, 1922, 3 ♀.

Massachusetts: Woods Hole, July, 1919, 1 ♂.

North Carolina: Jacksonville, Oct. 23, 1926, 1 ♀.

Georgia: Okefinokee Swamp, Billy's Island, June, 1912, 2 ♀.

Unfortunately the specimen in Mr. Emerton's collection which he used for comparison for many years was not *nigripalpis* but

purpurescens. This has caused considerable confusion and explains why he redescribed the species as *tarsalis*. We compared the types of *similis* and *nigripalpis* and found them identical.

***Ceratinopsis obscura* Emerton**

(Figures 29-30)

Ceratinopsis obscura Emerton, Can. Ent. 51: 105, pl. 7, fig. 2, 1919.

MALE. Length, 2 mm. Cephalothorax dark brownish, darker in front, rather broad, the sides converging towards the front. The cephalothorax is larger and the head broader than in *nigriceps*.

Posterior eyes in a straight line, the median a little more than the diameter apart and a little farther from the lateral. Anterior eyes in a slightly recurved line, the median close together but separated from the lateral by a little more than the diameter. Chelicerae brownish at base and lighter at tip. Sternum dark brown, shining, rather broad. Hind coxae separated by nearly the length. Legs brown, coxae margined at tip beneath with black.

Patella of palpus shorter than tibia without the apophysis. The tibia armed on the dorso-lateral angle with a stout process directed forward, rounded at tip and slightly excised at base on the mesal side. Back of this process the tibia is not so strongly thickened as in *nigriceps*. The paracymbium long, slender, curved in a semicircle with a small sharp hook at tip. Tail-piece of the embolic division long, the middle part extends in an open spiral to the tip of the bulb where the terminal part or embolus proper arises from it at an acute angle. The embolus is very slender and lies parallel to the middle part, the tip close to the bezel.

Redescribed and figured from the type, Minaki, Ont., July 10, 1917.

***Ceratinopsis purpurescens* Keyserling**

(Figures 31-35)

Ceratinopsis purpurescens Keyserling, Spinn. Am. Therid. 2: 187, pl. 17, fig. 248. 1886.

Ceratinopsis unicolor Crosby, Phila. Acad. Nat. Sci. Proc. 1905, p. 341.

MALE. Length, 1.8 mm. Cephalothorax dusky orange, blackish on the ocular area and immediately back of it; viewed from above evenly rounded on the sides with a very slight constriction at the cervical groove, broadly rounded across the front; viewed from the side gently and evenly arched

over the back to the posterior eyes. Clypeus concave below the eyes, somewhat protuberant across the middle.

Posterior eyes in a straight line, equal, separated by a little more than the diameter. Anterior eyes in a slightly procurved line, equal, the median separated by the radius and from the lateral by the diameter. Chelicerae reddish orange basally, fading to yellow distally. Sternum and labium dusky orange. Endites paler. Legs orange basally, nearly black distally. Abdomen reddish orange yellow in front becoming nearly black posteriorly. Spinnerets blackish.

Femur of palpus nearly straight dorso-laterally, curved inward, the inner face without hairs except for a row of six hairs on the distal half. Patella rather short and moderately curved downward. Ratio of length of femur to that of patella as 16 to 7. Tibia short and broad distally, armed mesally with a minute blunt tooth, the dorsal margin straight, armed laterally with a long, stout apophysis, the ventral surface of which is finely dentate, the lateral margin sinuate. The paracymbium strongly curved. The bezel rather high and broad. The tail-piece of the embolic division long and the tip curved inward on the edge of the tegulum. The middle part of the embolus rather stout and broad, making one-half turn after merging from behind the bezel, not produced beyond the break, the terminal part curved back along the middle part, rather stout, the tip lying next to the bezel. The tip of the embolus provided on the concave side with a thin, rather broad, hyaline projection.

FEMALE. Length, 2.3 mm. Resembles the male in form and color. The epigynum bounded in front by a transverse ridge; the middle quadrate area outlined by a row of hairs directed diagonally inward, the middle lobe broadly rounded behind.

A male and female from Columbia, Mo., were collected while mated and killed before they were able to separate. The embolus was inserted under the right side of the middle lobe at the angle which it makes with the lateral wall of the central fovea. All of the embolus beyond the point opposite the bezel was inserted. The epigynum containing the embolus was removed and cleared. It was found that the embolus after passing through the external opening turns first outward, then forward, inward and backward to form an almost complete circle with the "break" of the embolus lying very close to the point of entrance. The terminal part of the embolus, beyond the "break," takes a transverse course outward but the tip turns backward and lies just dorsad of the receptacles.

Type locality: Washington, D. C.

Massachusetts: Blue Hills, Boston, June 25, 1904, 2 ♂ (Emerton).

New York: Baiting Hollow (Sound Beach), L. I., May 23, 1924, 1 ♂, 2 ♀, May 31, 1923, 1 ♀; Yaphank, Aug. 29, 1916, 2 ♀; Cold Spring Harbor, June, 1921, 2 ♀ (E. G. Anderson).

New Jersey: Lakewood, April 16, 1910, 2 ♂, 3 ♀; Cassville, 1 ♂, 2 ♀ (determined by Emerton as *nigripalpis*).

Maryland: Plummers Id., May 18, 1913, 1 ♂ (Shoemaker); Little Paint Branch, June 9, 1912, 1 ♀ (Shoemaker).

Virginia: Great Falls, April 3, 1921, 2 ♂, 5 ♀; Rhododendron Run, May 18, 1912, 1 ♂ (Shoemaker).

North Carolina: Black Mt., North Fork Swannanoa River, 1 ♂, 1 ♀.

Kentucky: Quicksand, June 25, 1925, 1 ♀; Brooklyn Bridge, June 29, 1925, 3 ♀.

Missouri: Columbia, 1 ♂, 1 ♀, taken in coitu; May, 1904, 1 ♀; June 4, 1906, 1 ♀, taken with egg sac on under side of leaf.

Keyserling also records the species from Florida and Georgia.

Some confusion has arisen from the fact that Mr. Emerton's specimen of *C. nigripalpis* which he used instead of the type for comparison was not that species but was *C. purpurescens*.

Ceratinopsis sutoris new species

(Figures 36-38)

MALE. Length, 1.3 mm. Cephalothorax orange red, head black, the dark area broadly rounded behind and extended in front half way across the clypeus. Cephalothorax viewed from above evenly rounded on the sides with a very slight constriction at the cervical groove, the head broad, straight across the front, the lateral eyes slightly protuberant; viewed from the side, rather steeply ascending and gently arched to the posterior eyes. Clypeus strongly convex above and gently concave below, protuberant.

Posterior eyes in a straight line, the median separated by the diameter and a little farther from the lateral. Anterior eyes in a straight line, the median smaller than the lateral, subcontiguous, separated from the lateral by one and one-half times the diameter.

Chelicerae, sternum and endites orange red, the sternum roughened and suffused with dusky on the sides and behind. Legs and palpi pale orange yellow. Abdomen reddish, blackish in the middle and along the sides; in

another specimen pale reddish without black markings, tip black around the spinnerets.

Patella of palpus short; tibia short and broad, the dorso-lateral process large, pointed-triangular and minutely denticulate on the inner margin. At the base of this process on the mesal side are two slender black incurved teeth arising one above the other. The lower tooth has a minute denticle at its middle below. Paracymbium slender, bent in a right angle at middle and at an acute angle near tip, basally armed with a row of stiff hairs. Bezel transverse, ending in two sharp points towards the tip of the bulb. Tail-piece of the embolic division very long, slender, strongly curved and extending to the base of the cymbium; the middle part of the embolic division emerges from behind the bezel as a rather broad flattened rod which, after making one-half of a spiral turn, ends in a sharp point at the tip of the cymbium; the slender terminal part or embolus proper arises before this point on the mesal side and curves back along the middle part. The median apophysis appears as a conspicuous, brownish, flattened, sinuate, pointed tooth.

FEMALE. Length, 1.4 mm. Similar to the male in form and color. Anterior eyes in a slightly procurved line, the median smaller than the lateral, separated by the radius and from the lateral by three times the radius.

The epigynum has the transverse arm broad and short and covered from in front by a broad transverse lobe the posterior margin of which is gently concave. This lobe is strongly depressed across the middle.

Type, male: allotype, female. Eastern Branch near Bennings, D. C., Dec. 3, 1911 (Shoemaker).

District of Columbia: Eastern Branch, Feb. 23, 1913, 16 ♀ (Shoemaker).

Florida: Bunnell, Feb. 21, 1927, 1 ♂ (M. D. Leonard).

Louisiana: Baton Rouge, 2 ♀.

Ceratinopsis xanthippe Keyserling

Erigone xanthippe Keyserling, Spinn. Am. Therid. 2: 192, pl. 18, fig. 251. 1886.

This species, described from the female only, we place provisionally in the genus *Ceratinopsis*. The roughened sternum would relate it to *sutoris* but the figure of the epigynum precludes the possibility of their being identical.

CERATINOPSIDIS new genus

Type *Cornicularia formosa* Banks

While the type species of this genus has a superficial resemblance to *Ceratinopsis*, in which it was placed by Emerton, the

structure of the embolic division of the palpal organ clearly indicates that it is not closely related to that group. In *Ceratinopsis* the embolic division is of the spiral type as in *Ceraticelus*, *Grammonota*, etc. In *formosa* the embolic division is of a peculiar form and does not resemble that of any other species which we have studied.

Ceratinopsidis formosa Banks

(Figures 39-42)

Cornicularia formosa Banks, Phila. Acad. Nat. Sci. Proc. 1892, p. 34, pl. 5, fig. 35.

Lophocarenum venustum Banks, Same, p. 36, pl. 4, fig. 5.

Tmeticus luxuosus Banks, Same, p. 39, pl. 4, fig. 16.

Prosopotheca formosa Crosby, Phila. Acad. Nat. Sci. Proc. 1905, p. 307, 331.

Ceratinopsis alternata Emerton, Conn. Acad. Sci. Trans. 14: 185, pl. 2, fig. 6. 1909.

Banks (Phila. Acad. Nat. Sci. Proc. 1916, pp. 72, 73, and 74) states that *Tmeticus luxuosus* is the same as *C. alternatus* Em. and that *Cornicularia formosa* and *Lophocarenum venustum* equal *Gonatium rubens* Blackw. The latter statement is an error. The types of both *venustum* and *formosa* are females and the epigynum when viewed through a low power lens looks somewhat like that of *rubens*. When examined under a microscope they are seen to be the same as *C. alternatus* Em. In November, 1923, one of us examined these types with Mr. Banks and he concurred in our views.

MALE. Length, 2.1 mm. Cepalothorax orange yellow, viewed from above rather broad, evenly rounded on the sides behind, the sides nearly straight and convergent towards the front, head broad across the front, the eyes in profile. Cephalothorax viewed from the side gently and evenly arched over the back to the eyes. Clypeus vertical, slightly concave.

Posterior eyes in a straight line, equal, separated by the diameter. Anterior eyes in a straight line, the median smaller than the lateral, separated by a little less than the diameter and from the lateral by the diameter. Sternum, labium and endites orange yellow, the endites pale at tip. Legs and palpi yellow. Abdomen light gray. Spinnerets blackish.

Femur of palpus nearly straight. Patella rather large, curved downward, armed below at tip with a rather long round-tipped process gently curved forward. Ratio of length of femur to that of patella as 20 to 10. Tibia

short, greatly widened distally, the dorso-mesal margin produced into a short broadly rounded lobe, the dorso-lateral angle armed with a large erect process. Paracymbium rather small, strongly curved with short hook. Tegulum greatly enlarged ventrally produced into a large triangular point. Embolie division consists of a short boot-shaped tail-piece (the foot of the boot lying on the edge of the tegulum) from the side of which at the tip the middle part arises. This part is thin, short and black, armed on one side near the base with a sharp erect tooth and on the other side near the middle with a quadrate projection in the posterior corner of which is the opening of the ejaculatory duct. The embolus terminates in a stiff slender black style.

FEMALE. Length, 2.2 mm. Similar to the male in form and color. Epigynum is a weakly chitinized quadrate plate; the central fovea large, nearly square, broadly rounded in front.

Type locality: Ithaca, N. Y.

New Hampshire: West Swanzey, Sept. 3, 1926, 1 ♂, 1 ♀ (Forbes).

Vermont: East Corinth, Aug. 17, 1925, 1 ♂.

Massachusetts: Princeton, Sept. 13, 1922, 1 ♀; Aug., 1925, 1 ♀ (Forbes).

New York: Mt. Whiteface, 2300 ft., Aug. 25, 1916, 3 ♂ (Emerton det.); Wilmington, Aug. 24, 1921, 1 ♀; Wilmington Notch, Aug. 21, 1926, 1 ♂ (Emerton det.); High Falls, Essex Co., Aug. 23, 1921, 5 ♀, on under side of leaves; Elizabethtown, Aug. 21, 1921, 2 ♀; Newcomb, Sept. 20, 1924, 1 ♂, 1 ♀; Whetstone Gulf, Lewis Co., Sept. 2, 1926, 1 ♂, 1 ♀; Cranberry Creek, Pinnacle Mt., Aug., 1911, 4 ♂, 15 ♀ (Emerton det.); Rock City, Cattaraugus Co., Aug., 1918, 1 ♂, 2 ♀; Montour Falls, Sept. 21, 1924, 2 ♀; Ithaca, July 12, 1925, 1 ♂, Aug. 6, 1922, 1 ♀; Mt. Utsayantha, Oct. 21, 1924, 1 ♀; Silver Bay, Sept. 15, 1925, 1 ♀ (Leonard); Juanita Island, Lake George, Aug. 4, 1920, 3 ♂, 2 ♀; Shelving Rock Mt., July 27, 1920, 15 ♂, 2 ♀; Pearl Point, Lake George, July 29, 1920, 2 ♂, 1 ♀; Lake Bluff, Sept. 9, 1920, 3 ♀; Lancaster, 1 ♂ (Van Duzee); Queechy Lake, Aug. 26, 1920, 1 ♂ (Schoonmaker); Hunter, Aug. 10, 1923, 1 ♂, Aug. 16, 1925, 2 ♂, 1 ♀ (Mills & Frane); Riverhead, Sound Beach, Sept. 10, 1922, 1 ♀.

Pennsylvania: Arendtsville, 1 ♀ from stomach of *Hyla crucifer* (S. W. Frost); New Bloomfield, Oct. 31, 1924, 2 ♀; Hazleton, July 4, 1925, 1 ♀ (Dietz).

Maryland: Glen Echo, 1925, 1 ♀ (Fouts).

Virginia: Alberta, Oct. 27, 1923, 1 ♀; near Georgetown, D. C., Sept. 27, 1913, 2 ♀ (Shoemaker); Rocky Mount, Oct. 8, 1923, 1 ♀; Blacksburg, Oct. 4, 1926, 3 ♀ beating.

North Carolina: Nantahala Gap, Macon Co., Oct. 11, 1926, 1 ♀; Hendersonville, Stoney Mt., Oct. 18, 1923, 1 ♀; Madison, Oct. 8, 1923, 6 ♀; Grandfather Mt., Oct. 12, 1923, 1 ♀; Hinton's Falls, Dec. 21, 1923, 1 ♀ (Mabee); Mt. Pisgah, Oct. 13, 1926, 2 ♀; Base of Mt. Pisgah, Oct. 19, 1923, 1 ♀; Raleigh, Oct. 26, 1923, 5 ♀.

Tennessee: Mt. Leconte, Mill Creek below Falls, Oct. 10, 1926, 11 ♀.

Emerton has recorded this species from New Hampshire: Three-mile Id.; Jaffney; Massachusetts: Mt. Tom; Connecticut: Simsbury; North Carolina: Balsam.

TUTAIBO Chamberlin

Mus. Comp. Zool. Bul. 60 (6): 237, 1916.

Type: *T. debilipes* Chamberlin.

This genus is rather closely related to *Ceratinopsis* in the structure of the embolic division of the bulb of the male palpus but differs from it in the armature of the tibia of the male palpus, in the extraordinary length of the embolus, and in the long, slender legs.

Tutaibo debilipes Chamberlin

(Figures 43-44)

Tutaibo debilipes Chamberlin, Mus. Comp. Zool. Bul. 60 (6): 237, pl. 17, figs. 9, 10, 1916.

Tibia of male palpus longer than patella and greatly widened distally on the lateral side so that end of the segment is triangular with a small sharp tooth near each angle. The paracymbium slender and only slightly hooked at tip. The embolic division of the spiral type as in *Ceratinopsis*. The tail-piece long, thin, curved and somewhat twisted; the middle part stout, black and spirally coiled in one turn, continued in a sharp point beyond the insertion of the embolus. The embolus slender and of extraordinary length arising from the middle part at nearly a right angle. It then follows a complicated course over the face of the bulb as shown in figure 44.

Peru: Huadquina, 5000 ft., July, 1 ♂, the type.

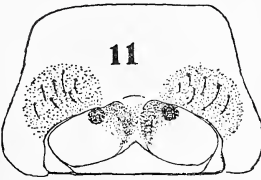
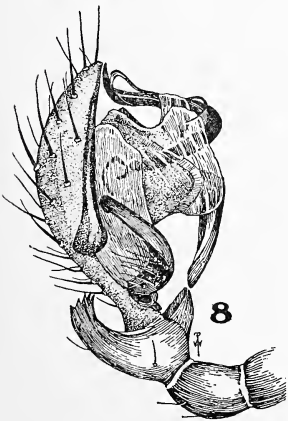
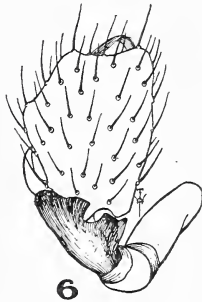
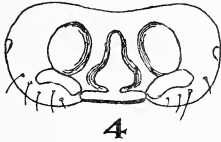
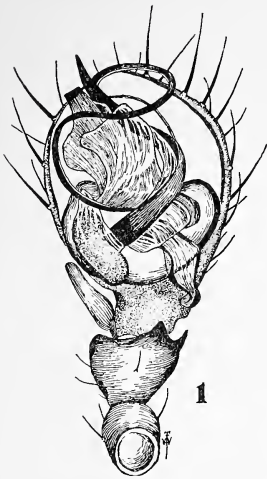
PLATES III TO VI

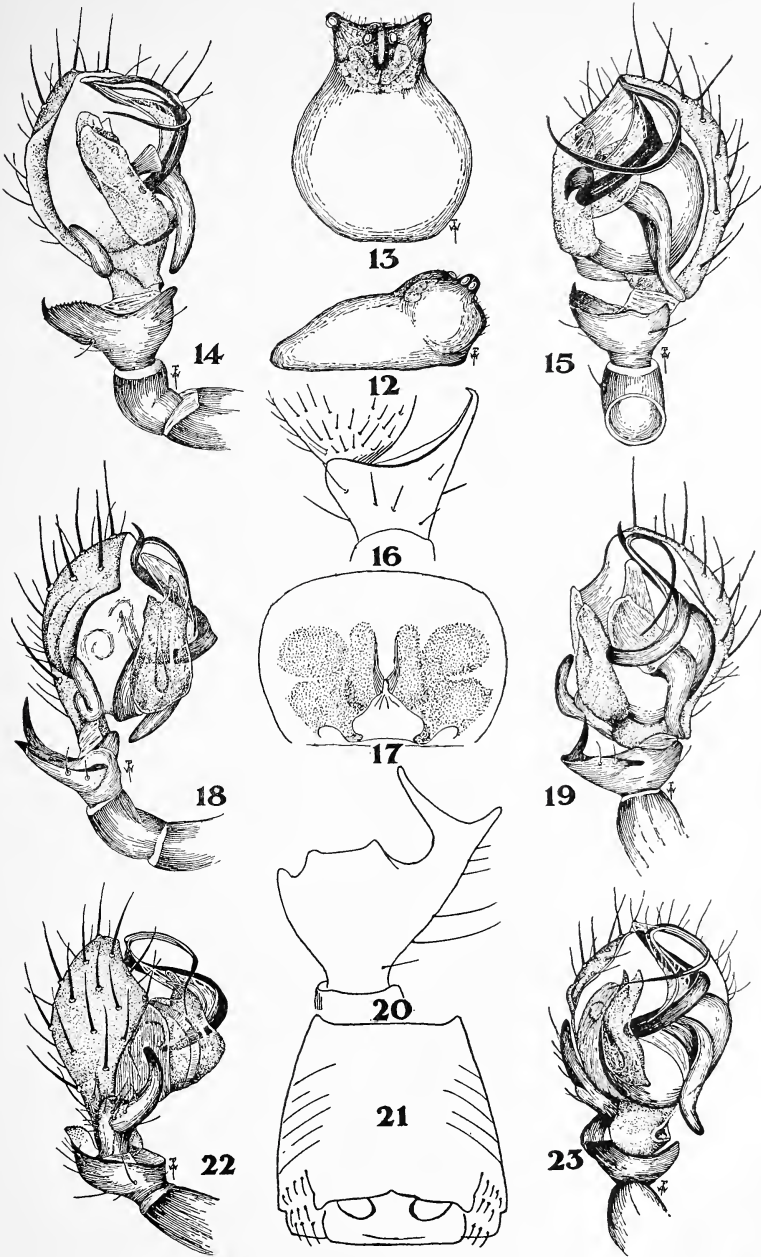
EXPLANATION OF FIGURES

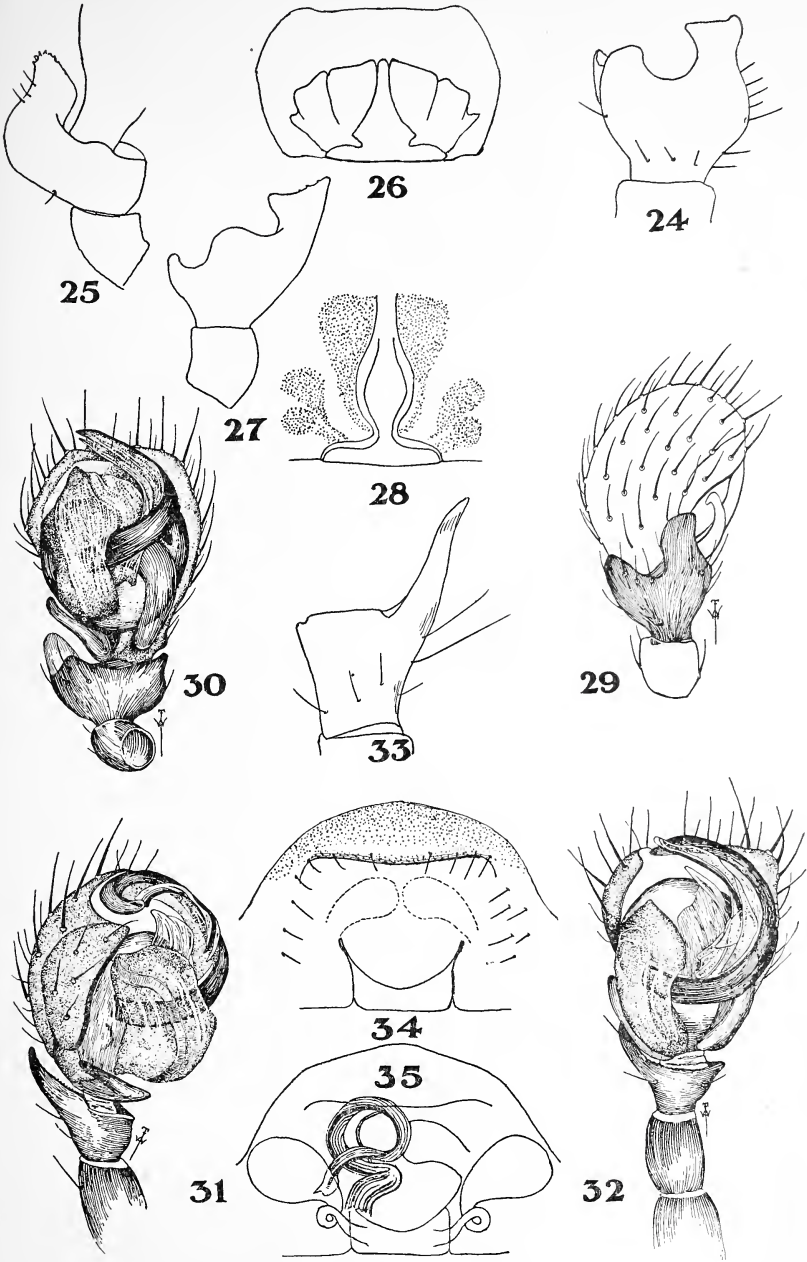
1. *Ceratinopsis anglicana*, ♂ right palpus, ventral view.
2. *Ceratinopsis anglicana*, ♂ right palpus, lateral view.
3. *Ceratinopsis anglicana*, ♂ right palpus, tibia, dorso-lateral view.
4. *Ceratinopsis anglicana*, ♀ epigynum.
5. *Ceratinopsis atolma*, ♂ left palpus, ventral view.
6. *Ceratinopsis atolma*, ♂ left palpus, dorso-mesal view.
7. *Ceratinopsis atolma*, ♂ left palpus, tibia, meso-dorsal view.
8. *Ceratinopsis auriculata*, ♂ right palpus, lateral view.
9. *Ceratinopsis auriculata*, ♂ right palpus, ventral view.
10. *Ceratinopsis auriculata*, ♂ right palpus, tibia, dorsal view.
11. *Ceratinopsis auriculata*, ♀ epigynum.
12. *Ceratinopsis auriculata*, ♂ cephalothorax, lateral view.
13. *Ceratinopsis auriculata*, ♂ cephalothorax, dorsal view.
14. *Ceratinopsis interpres*, ♂ right palpus, ventro-lateral view.
15. *Ceratinopsis interpres*, ♂ right palpus, ventral view.
16. *Ceratinopsis interpres*, ♂ right palpus, tibia, dorsal view.
17. *Ceratinopsis interpres*, ♀ epigynum.
18. *Ceratinopsis laticeps*, ♂ right palpus, lateral view.
19. *Ceratinopsis laticeps*, ♂ right palpus, ventral view.
20. *Ceratinopsis laticeps*, ♂ right palpus, tibia, dorsal view.
21. *Ceratinopsis laticeps*, ♀ epigynum.
22. *Ceratinopsis nigriceps*, ♂ right palpus, lateral view.
23. *Ceratinopsis nigriceps*, ♂ right palpus, ventral view.
24. *Ceratinopsis nigriceps*, ♂ right palpus, tibia, dorsal view.
25. *Ceratinopsis nigriceps*, ♂ right palpus, tibia, lateral view.
26. *Ceratinopsis nigriceps*, ♀ epigynum.
27. *Ceratinopsis nigripalpis*, ♂ right palpus, tibia, dorsal view.
28. *Ceratinopsis nigripalpis*, ♀ epigynum.
29. *Ceratinopsis obscura*, ♂ right palpus, dorsal view.
30. *Ceratinopsis obscura*, ♂ right palpus, ventral view.
31. *Ceratinopsis purpurescens*, ♂ right palpus, lateral view.
32. *Ceratinopsis purpurescens*, ♂ right palpus, ventral view.
33. *Ceratinopsis purpurescens*, ♂ right palpus, tibia, dorsal view.
34. *Ceratinopsis purpurescens*, ♀ epigynum.
35. *Ceratinopsis purpurescens*, ♀ epigynum, with embolus of male palpal organ in place.
36. *Ceratinopsis sutoris*, ♂ right palpus, ventral view.
37. *Ceratinopsis sutoris*, ♂ right palpus, lateral view.
38. *Ceratinopsis sutoris*, ♀ epigynum.
39. *Ceratinopsidis formosa*, ♂ right palpus, lateral view.

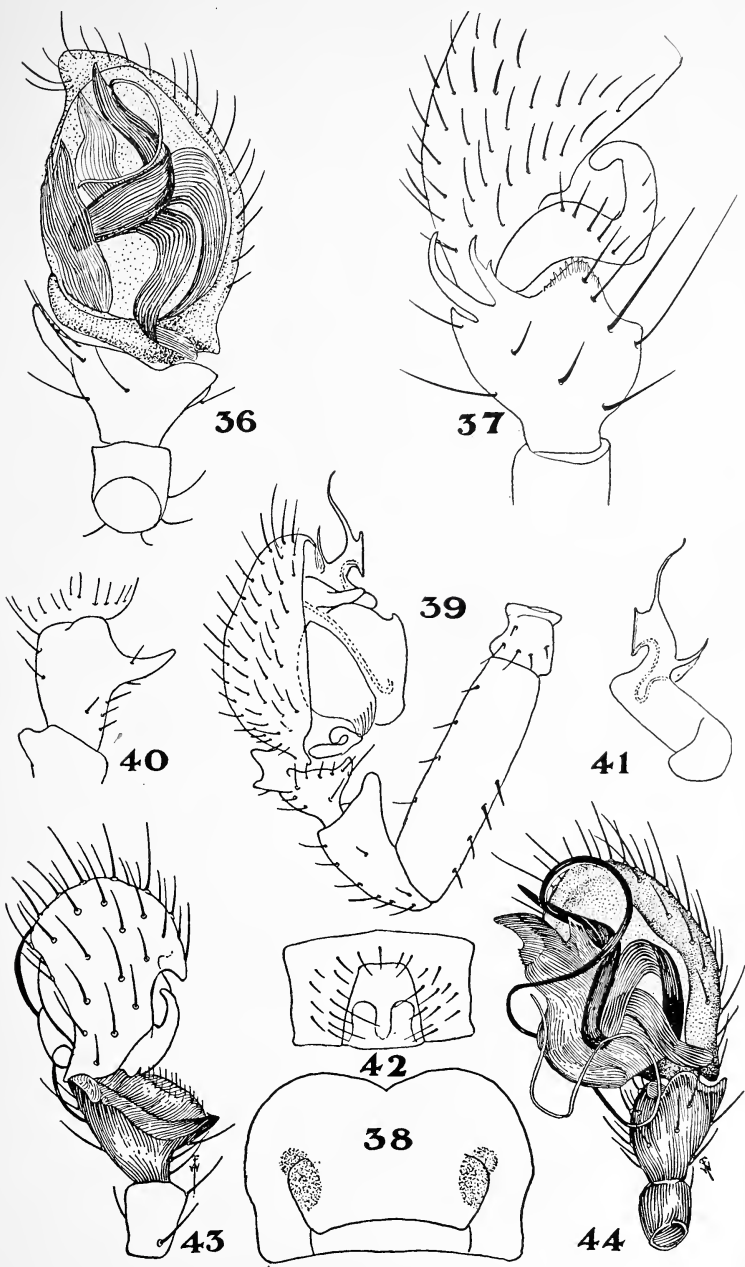
40. *Ceratinopsidis formosa*, ♂ right palpus, tibia, dorso-mesal view.
41. *Ceratinopsidis formosa*, ♂ embolic division of right palpal organ.
42. *Ceratinopsidis formosa*, ♀ epigynum.
43. *Tutaibo debilipes*, ♂ right palpus, dorsal view.
44. *Tutaibo debilipes*, ♂ right palpus, ventro-mesal view.

The preparation of many of the drawings, by Albert W. Force, of Ithaca, N. Y., was made possible by a grant from the Heckscher Research Foundation at Cornell University.









OLAUS MAGNUS, CREDULOUS ZOOLOGIST, AND ARCHBISHOP OF THE SIXTEENTH CENTURY

BY HARRY B. WEISS,
NEW BRUNSWICK, N. J.

Perhaps it is wrong to call Olaus Magnus a zoologist. Nevertheless he wrote about animals, and he was credulous—at a time, however, when credulity was not uncommon.

Authors usually believe what they themselves write, and Olaus wrote that in the regions of the North, the bees infested drunkards, and stung them, being attracted by the odor of their rum-soaked bodies. Apparently only hydropots were safe from their attacks. Hornets, too, if his illustrations can be relied upon, were quite savage, killing both men and beasts, and northern bears went mad after eating the narcotic *Mandragora* but recovered by eating ants.

Of the were-wolves, he wrote, "They go into the Beer-Cellars, and there they drink out some Tuns of Beer or Mede, and they heap al the empty vessels, one upon another in the midst of the Cellar, and so leave them; wherein they differ from natural and true Wolves." Ducks in Scotland, he said, according to a Scotch historian, "breed of a certain Fruit falling in the Sea; and these shortly after, get wings, and fly to the tame or wild ducks." He wrote that swallows hibernated under water, that the griffin preyed upon horses and men, that the sea cow, "is known to have lived 130 years, by cutting off her tail," and of the sea-serpent, he said, "They who Work of Navigation, on the Coasts of Norway, employ themselves in fishing, or merchandize, do all agree in this strange Story, that there is a Serpent there which is of a Vast Magnitude, namely 200 feet long, and moreover, 20 foot thick; and is wont to live in Rocks and Caves toward the Sea Coast about Berge; which will go alone from his holes in a clear night in Summer, and devour Calves, Lambs, and Hogs, or else he goes into the Sea to feed on Polypus, Locusts, and all sorts of Sea Crabs. He hath commonly hair hanging from his neck a cubit long, and sharp Scales, and is black, and he hath flaming

shining eys. This Snake disquiets the Shippers, and he puts his head on high like a pillar, and catcheth away men, and he devours them; and this hapneth not, but it signifies some wonderful change of the Kingdom near at hand; namely that the Princes shall die, or be banished; or some Tumultuous Wars shall presently follow."

All of which, and more of the same kind, appears in his work on history, geography and natural history known briefly as a "History of the Northern Nations," in which he also displays his dislike of the Protestants. Consisting of twenty-two parts, it deals with the political and commercial life of the northern countries, the customs of the people, the land and its minerals and animals. According to Hagen, it is a folio of 815 pages, of which pages 779 to 801 are devoted to insects. It was printed in Rome in 1555 and later editions were published in Antwerp in 1558, Basle in 1567 and Frankfort in 1618. It was also translated into German, Italian, Dutch and English, the English edition appearing in London in 1658.

Olaus also wrote a life of Catharine, daughter of the Swedish St. Bridget, "*Vita Catharinæ*" and edited some of his brother's books. His knowledge of the North was said to have been quite extensive for his time, and part of his activity consisted in the preparation of a map of the northern lands, which appeared in Venice in 1539.

Born at Skeninge, Sweden, in 1490, he studied in Germany from 1510 to 1517, and then entered higher religious service and was made cathedral provost at Strengnas. In 1523 King Gustave I named his brother John, Archbishop of Upsala and dispatched Olaus to the Pope to have the appointment confirmed. John Magnus was fiercely opposed to the Protestant religion and tried unsuccessfully to prevent the king from introducing it into Sweden. In 1537 John went to Rome and Olaus accompanied him as his secretary, having lost his property when the king confiscated the church lands. Both suffered annoyances while in Sweden as a result of their attachment to the Church. When John died in 1544, Olaus was appointed Archbishop of Upsala, but he never entered into office, and lived the remainder of his

life in Italy, mainly in Rome. In 1545 Paul III commissioned him to attend the Council of Trent, which he did until 1549. He died in Rome, August 1, 1558, and was buried in St. Peter's. Zoologically he belonged to the Middle Ages.

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SYNONYMICAL NOTES ON MEMBRACIDÆ

BY FREDERIC W. GODING

During a recent review of the literature and material on the Membracidæ a number of synonyms and misconceptions relative to the genera and species were noted, some of which are herein recorded.

Subfamily ÆTHALIONINÆ

*Oclasma** Melich., Wein. Ent. Zeit. xxiv, p. 284 (1905), is *Coloborrhhis* Germ. (1836). *Oclasma degenerata** Melich. (1905) is *Coloborrhhis perspicillata* Gerst.

Sarritor Dist. (1916) is *Hemicentrus* Melich. (1914). *Cicada bispinus** Stoll (1783), from Ceylon, belongs to *Hemicentrus*.

As *Lamproptera* was first used by Gray, in 1832 (in Griff. Ann. King., pl. 102, fig. 4), for a genus in the Lepidoptera, the membracids listed under *Lamproptera* Germar (1833) require a new generic name for which *Biturritia* is proposed with *capreolus* Germ., as the type.

Subfamily CENTROTINÆ

The genus *Phærotus* Buckt. (1903) is *Coccosterphus* Stal (1869).

*Centrotus malayus** Stal, Eug. Res. Om. Jord., p. 285 (1859) is *Gargara semifascia* Walk. (1856), both from Malacca.

Xanthosticta grisea Buckt., and *Xanthosticta trivialis* Buckt., belong to the genus *Gargara* Am. y Serv; *Xanthosticta luzonica* Buckt., and *Gargara sibirica* Leth., belong to the genus described by Distant as *Tiberianus* (1915) with three carinæ on the front of the pronotum. As *Xanthosticta* Buckt. (1903) was first published, *Tiberianus* becomes a synonym; the type is *luzonica* Buckt.

Recently while studying the membracidæ in the United States National Museum at Washington, four examples of *Machærotypus sellatus* Uhler, from Japan, were located which proved to

* Omitted from Funkhouser's Catalog of the Membracidæ.

be the species described and figured as *Maurya brevicornis* Funkh., and *Tricentrus vitulus* Lindberg, also from Japan, both being synonyms; while *Maurya* Dist. (1916) is a synonym of *Machærotypus* Uhler (1896), whose description should be amended by adding "with short distinct auricular supra-humerals, wings with three apical cells, ocelli some nearer to and above center of eyes." As the species listed under *Maurya* belong to *Machærotypus* Uhler, those (excepting *sellatus*) listed under *Machærotypus* Melichar are without a generic name, *Melicharella* is proposed for them with *Machærotypus incultus* Melich., as the type.

Two examples, male and female, of *Orthobelus flavipes* Uhler (1896) are in the National Museum collection which entirely agree with the description of *Tricentrus basalis* Walk. (1851), both from Japan.

The species listed in the genus *Maguva* Melich., apparently belong to at least two distinct genera, those properly included in *Maguva* agreeing with *horrida* Melich. and *typica* Dist. in having the posterior pronotal process distinctly angulate near base and lobate at middle beneath, while in the others as *serpentinus* Funkh., the process is strongly sinuate or undulate from base. For those with a sinuate posterior pronotal process the name *Evanchon* is proposed, with *Anchonoides serpentinus* Funkh. (Jour. St. Br. R. A. Soc., p. 209, pl. 1, f. 3-4 (1920), as the type.

The genus *Leucothorax* (Buckt., is the genus *Centruchus* Stal.

Centrotypus alatus Buckt. (1903, from Sumatra, was renamed *Centrotypus perakensis* by Distant (1916) under the impression that *Hemiptycha alata* Fairm., was from India and cogenetic; whereas *alata* Fairm., is from Brazil, and belongs in the genus *Sundarion*, subfamily *Darninæ*, and *perakensis* Dist. becomes a synonym of *alata* Buckt.

As the genus *Lobocentrus* Stal has three discoidal cells in each tegmen, and the genus *Dograna* Dist. has but two, the character is quite sufficient to separate them, although otherwise they are similar.

There appears to be a misconception of Walker's genus *Micreune* among students of this group which may be cleared up by comparing the descriptions and figures of the several nominal

species listed under that name. In his description of the genus Walker states that the "hind part of the thorax armed with a horizontal horn which extends to near half the length of the abdomen," which is clearly shown in his figure, and that of Buckton, and also that the posterior process is rather close to the abdomen (the process is shown too long in Buckton's figure). These characters apply only to *formidenda* Walk., the one known species of the genus. To his description of *Micreune metuenda* Walker adds "*C. dama* and *gazella* probably belong to this genus," thus recognizing their close relationship. The species *dama* and *gazella*, as in all the species of the genus *Leptobelus*, have the posterior process emitted from the front pronotal process (not from the "hind part of the thorax"), very distant from the body, and about as long as the tegmina. These characters are seen in Buckton's figure of *Micreune macularum*, which doubtless is Walker's *metuenda*, all members of the genus *Leptobelus*.

The description of *Centrotus alticeps* Walk., proves it to be foreign to the modern genus *Centrotus*, but agrees with the characters of the genus *Leptobelus*, noticed by Walker as he adds "Like *C. gazella* in structure." It should be included in the genus *Leptobelus* Stal.

"*Micreune ? electa*" Melich. is not a *Micreune*; judging from the description, it should be placed in the genus *Congellana* Distant.

Hemiptycha balista Germ. (1835), from India is *Hypsauchenia harwicki* Kirby (1829). The true *Sphongophorus balista* was first described by Amyot y Serville, in Hemip., p. 535, pl. 9, fig. 5 (1843).

The genus *Platyceras* Schm., preoccupied in the Mollusca (1837), (1926) is *Hybandoides* Dist., (1915); *Hybandoides* must stand as the name of the genus, with *Platyceras* as a synonym.

The African genus *Negus* Jac., is closely allied to the genus *Centrochares* Stal, but differing in the pronotum which is covered with hair-bearing nodules, shorter more nearly straight and robust posterior process which impinges on the scutellum nearly covering it.

Subfamily MEMBRACIDÆ

The genus *Clonauchenia* described by Funkhouser in 1921, is the genus *Bulbauchenia* described by Schumacher in 1915.

Subfamily DARNINÆ

Stictopelta varians Fowl., (1894) is *Stictopelta arizona* Godg., (1895); *Stictopelta lineifrons* Fowl., (1894) is *Stictopelta nova* Godg., (1892).

Membracis bonasia Fabr., (1775) doubtless is *Sundarion xanthographa* Germ., (1835).

THE INSECT VISITANTS AND INHABITANTS OF MELILOTUS ALBA¹

BY M. A. STEWART

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A study was made throughout the summer of 1928 to determine at least the more common insect visitors and inhabitants of white sweet-clover (*Melilotus alba*) in and about Ithaca, New York. This study began just before the blossoming of the plants and continued until after the seeds had ripened. Various white sweet-clover patches were visited and these visits were arranged so that collections were made at all hours from dawn till dark. Several hundred roots were examined and about an equal number of stalks were cut open but in no case were insects found either on or in the roots, or within the stalks. Neither were insects found feeding on the seeds. During the summer of 1928 at least, very few leaf miners were found on these plants. As will be seen below the very great majority of insects collected were flower visitors.

Orthoptera

Melanoplus femur rubrum was found in great numbers, during the first week of September, climbing on the stalks and petioles of *Melilotus alba*.

Odonata

Enallagma civile Hagen was constantly found in numbers about *M. alba* feeding upon its insect visitors. This species was determined by Dr. James G. Needham.

Hemiptera

The following Hemiptera were collected throughout the summer, but never more than one or two specimens, crawling over the leaves: *Nabis subcoleoptratus* Kirby, *Sinea diadema* Fabr., *Podisus maculiventris* Say, *Miris dolabrata* L., *Lygus pratensis*

¹ A contribution from the Entomological Laboratory of Cornell University.

L., *Adelphocoris rapidus* Say, and *Paracalocoris scrupens* Say. These specimens were determined by W. L. McAtee of the United States National Museum.

Homoptera

Philænus spumarius var. *ustulatus* Fall and *P. s. pallidus* Zett were frequently found feeding upon the leaves of *Melilotus alba* throughout the entire summer. One specimen of *P. spumarius marginellus* Fabr. was collected feeding on a leaf. These homopterans were determined by Mr. McAtee.

Illinoia pisi Kalt., determined by Dr. P. W. Mason of the U. S. National Museum, was very abundant at certain times during the summer; notably from the middle of June to the first of July and from the middle of July to the latter part of August. Between these two periods hardly a specimen was to be found. These aphids were observed to feed almost exclusively on the under surfaces of the leaves.

Coleoptera

Adalia bipunctata L., and *Coccinella novemnotata* Hbst., were very abundant on the plants at the same times that *Illinoia pisi* was. They were feeding upon the aphids.

Chauliognathus pennsylvanicus Deg., was extremely abundant during the first half of August. Great numbers were observed in copula. These insects were found chiefly about the flowers.

Scattered specimens of *Cycloneda munda* Say, *Dibolia borealis* Chevr., *Trirhabda canadensis* Kby., and *Hemicrepidius decoloratus* Say were found on the leaves and flowers of *M. alba* throughout the summer.

The above coleoptera were determined by Dr. E. A. Chapin of the National Museum.

Lepidoptera

But one lepidopterous leaf-miner, *Micrurapteryx kollariella* was found upon white sweet-clover. This is a European species and has not been previously collected in the United States.

During the entire summer *Pieris rapæ* L. was very common about the flowers.

During the middle of July egg masses of *Estigmene acraea* Dru., were common on the stalks of the plants. These egg masses consisted of from thirty to forty eggs, which were closely glued together in a flat, single-layered mass. Eggs collected on July 16 hatched July 18; the larvæ pupated August 18 and the adults emerged, mated, and oviposited on September 4. The larvæ caused considerable defoliation.

Specimens of *Crambus hortuellus* Grt., *C. prafectellus* Zuick., and *C. luteotellus* Clem., were fairly common throughout the entire summer.

Occasional specimens of the following species were collected: *Everes comyntas* Gdt., *Phyciodes tharos* Gn., *Laspeyresia interstinctana* Clem., and *Platyptilia pallidactyla* Haw.

The Lepidoptera listed above were determined by Dr. W. T. M. Forbes of Cornell University.

Diptera

The only dipterous leaf-miner on *Melilotus alba* was *Agromyza pusilla* Meig. The serpentine mines caused by this insect were not uncommon.

The only other dipteran that was collected in any numbers was *Pollenia rudis* Fab., (determined by Dr. J. M. Aldrich). This species was found throughout the summer.

Occasional specimens of *Mesogramma geminata* Say and *Sphærophoria cylindrica* Say were collected. Both of these species were determined by Dr. C. T. Green of the National Museum.

Rare collections of the following flies were made: determined by Dr. Green—*Tabanus costalis* Wied., *Syrirta pipiens* L., *Eristalis transversus* Wied., and *Psilopus scobinator* Loew.; determined by Dr. Aldrich—*Wohlfahrtia vigil* Walk., *Archytas analis* Fab., *Trypeta florescentiae* L., *Oncomyia loraria* Lw., *Phleomyia indecora* Lw., *Spallanzania hesperidarum* Will., *Lucilia sericata* Mg., and *L. sylvarum* Mg.; determined by Mr. F. M. Hull of the Division of Entomology, Texas State Agricultural Experiment Station—*Platychirus peltatus* Meig., and *P. hyperöbreus* Staeger.

There is no record of a previous collection of *Oncomyia loraria* Lw., from New York State.

Hymenoptera

Apis mellifera L., was found in great numbers, even on days when there was a strong wind, throughout the entire blossoming season.

The following specimens, determined by Miss G. Sandhouse of the U. S. National Museum, were collected on *M. alba*: *Halictus provancheri* D. T., *Ancistrocerus capra* Sauss., *A. unifasciatus* Sass., *A. parietum* L., *A. tigris* Sauss., *A. catskillensis* Sauss., *Halictus leuorouxii* Lep., *H. craterus* Lovell, *H. fuscipennis* Sm., *H. pectoralis* Sm., *H. sparsus* Robt., *H. ligatus* Say, *H. lineatulus* Cwfd., *Sphecodes confertus* Say (?), *Hylæus* sp. near *stevensi* Cwfd., *Andrena* sp., *Philanthus bilunatus* Cr., *P. politus* Say, *Cerceris nigrescens* Sm., *Cerceris* sp., *Oxybelus quadrinotatus* Say, and *Psen* sp.

Of these species *Halictus provancheri* D. T., *Ancistrocerus catskillensis* Sauss., *Halictus sparsus* Robt., and *Hylæus* sp. near *stevensi* Cwfd., were common throughout the season. The other species were relatively rare.

Halictus craterus Lovell, *H. pectoralis* Sm., *H. sparsus* Robt., *H. lineatulus* Cwfd., and *Sphecodes confertus* Say (?) have not been recorded heretofore from New York State.

Formica fusca var., determined by Dr. W. M. Mann of the National Museum, was found throughout the whole summer crawling over the stalks, stems, and leaves.

One specimen each of *Plectocryptus* n. sp., and *Casinaria genuina* Nort., were collected on white sweet-clover. *Casinaria genuina* Nort., has not been previously recorded from New York State. Dr. R. A. Cushman of the National Museum determined these species.

One undetermined sawfly was collected.

Polistes pallipes Lep., and *Bicyrtes ventralis* Say were relatively common on *M. alba* throughout the summer. These species were determined by Dr. P. P. Babiý of Cornell University.

AN INJURIOUS MEMBRACID

BY FREDERIC W. GODING

The Membracidæ are usually, and as a rule rightfully classed as innoxious, the only case of any degree of importance heretofore recorded against them being as enemies of potatoes, although they are frequently found on fruit and shade trees with no apparent ill effects.

In 1921, while passing through the Canal Zone, Dr. James Zetek, Government Entomologist in charge of the Biological Station, informed me that a membracid was infesting various shrubs and trees in countless numbers in the vicinity of Panama, with very injurious effect. They were so plentiful that they covered the bark of the twigs and branches to such an extent that the bark could not be seen. Dr. Zetek obtained several photographs of some of the infested trees, three of them accompanying this account. As it is unusual to find a membracid on a list of injurious insects it seems opportune to place this occurrence on record.

Amyot and Serville in 1843 described this insect (Hemipteres, p. 543, pl. 10, fig. 1) as *Physoplia crassicornis* and *Physoplia nigrata*, since when it has been redescribed and figured many times under various names, but now is known as *Umbonia crassicornis*. It is frequently seen in Mexico, Central and South America.

PLATE VII

- FIG. 1. *Umbonia crassicornis* in the several stages.
FIG. 2. Near view of infested branches.
FIG. 3. A badly infested tree.



MEMBRACIDÆ

JOHN BUNCLE'S PANEGYRIC ON THE SPANISH FLY

BY HARRY B. WEISS

NEW BRUNSWICK, N. J.

Every time I read the "Life and Opinions of John Bunclé, Esquire" by Thomas Amory, I find some diverting account which I had overlooked previously. Mention has been made of Bunclé's narrative of the battle between a flea and a louse* and his remarks on the "Spanish fly" and its vesicating properties are equally as amusing and furnish some evidence concerning the state of thought in 1756. Undoubtedly some present day writings will be equally as entertaining after the passage of a hundred or two hundred years.

Although the mathematical, medical, biological and other discussions in which the book abounds probably served no better purpose than to display the pansophism of the author, Thomas Amory, yet such opinions must have been current to some extent when the book was written, even though seldom expressed in such grandiose language. Speaking of a visit on July 2, 1734, to one Dr. Stanvil, Mr. Bunclé proceeds pompously as follows:

"As he had an Essay on Fevers in his hand, when I entered the room, I requested to know how he accounted for the effects of Cantharides, in raising and strengthening a low trembling pulse, and driving the natural heat and efflatus of the blood outward, in giving relief in delirious ravings, stupors, and loss of reason, in reducing continual fevers to distinct remissions, and in cleansing and opening the obstructed glands and lymphatics, so as to bring on the critical sweats, let loose the saliva and glandular secretions, and bring down the thick soruble urine? How does blistering, so happily brought in by the physical bully of this age, Dr. Radeliffe, so wonderfly cool and dilute the blood? It seems to me somewhat strange.

* Journal of the New York Entomological Society, vol. xxxiii, pp. 114-115.

“It is easily accounted for,” replied Dr. Stanvil. “The Spanish fly, an extremely hot and perfectly caustic insect, is stocked with a subtile, active, and extremely pungent salt, which enters the blood upon the application of the blister, and passes with it through the several glandular strainers and secretory ducts. This stimulating force of the fly’s salt, occasions the pain felt in making the water with a blister, which may be taken off by a thin emulsion made with the pulp of roasted apples in milk and water, and causes the liberal, foul, and stinking sweats, while the Epispastic is on.

“This being evident, it is plain from thence, that the penetrating salts of the fly, that is, the volatile pungent parts of the cantharides, act in the blood by dissolving, attenuating, and rarifying the viscid cohesions of the lymph and serum; by stimulating the nervous coats of the vessels, throw off their stagnating viscidities, and by cleansing the glands, and forcing out the coagulated serum, restore the circulation and freedom of lymph from the arteries to the veins; opening, scouring and cleansing at the same time, the expurgatory glands.

“In short, as common cathartics purge the guts, and cleanse and throw off their clammy, stagnating, and obstructing contents, by rarifying and dissolving the viscid cohesions of the fluids, and by stimulating the solids; so do the active salts of the fly penetrate the whole animal machine, become a glandular lymphatic purge, and perform the same thing in all the small straining conveying pipes, that common purgatives effect in the intestines: and as by this means, all the sluices and outlets of the glandular secretions are opened, the cantharides must be cooling, diluting, and refrigerating in their effects to the greatest degree, though so very hot, caustic, and pungent in themselves. So wonderfully has the great Creator provided for his creature, man; in giving him not only a variety of the most pleasing food, but so fine a medicine, among a thousand others, as the Spanish fly, to save him from the destroying fever, and restore him to health again. It is not by a discharge of serum, as too many doctors imagine, that a blister relieves, for five times the quantity

may be brought off by bleeding, vomiting, or purging; but the benefit is entirely owing to that heating, attenuating, and pungent salt of this fly, and this fly only, which the divine power and goodness has made a lymphatic purgative, or glandular cathartic for the relief of man, in this fatal and tormenting malady. Vast is our obligation to God for all his providential blessings. Great are the wonders that he doth for the children of men."

THE DISTRIBUTION OF CICADAS IN THE UNITED STATES WITH DESCRIPTIONS OF NEW SPECIES

BY WM. T. DAVIS,

STATEN ISLAND, N. Y.

In North America north of Mexico one hundred and forty named forms of cicadas are now known to occur of which about one hundred and twenty-seven may be considered species, though some of the others will likely be so regarded in the future. The best known of the number is the famous *Magicicada septendecim* L., which, with the race *tredecim* Riley, and the smaller form *cassinii* Fisher, occurs from the New England and South Atlantic States westward to the eastern part of Nebraska, Kansas, Oklahoma and Texas.

Of the large cicadas of the genus *Tibicen*, the usual coloring of which is black and green, fifteen species inhabit the eastern half of the United States and no member of the genus has so far been recorded from the states bordering the Pacific. *Tibicen canicularis* Harris, that extends from Nova Scotia to Manitoba and the mountains of Colorado, has thus a wide distribution in the north, while further south and occupying the territory from the New England States to Florida and westward to about the 100th meridian, the most wide-spread species are *linnei* S. & G., *chloromera* Walker, *lyricen* De Geer, and *auletes* Germar, this last being one of our largest cicadas. *Tibicen similaris* S. & G. appears to be confined to the southeastern states from Virginia to Louisiana, and is usually found in the lowland; *figurata* Walker, occurs from Arkansas and Tennessee south to Louisiana and Florida; *resonans* Walker, occurs from North Carolina to Florida, Louisiana and Kansas, though there are several gaps, such as Arkansas and Oklahoma; *davisi* S. & G., occurs in all the coast states from New Jersey to Mississippi and northward to Arkansas. The beautifully marked *latifasciata* Davis, occurs along the coast from New Jersey to North Carolina and probably to the

Gulf of Mexico; *winnemanna* Davis, is more of an inland species and occurs from Pennsylvania to Illinois and south to Alabama and Georgia, while *robinsoniana* Davis, occurs from Virginia westward to Missouri. In the general region of the Mississippi and its tributaries, are found *Tibicen pruinosa* Say, *T. aurifera* Say, and *T. superba* Fitch, the last being a unique species mostly green in color.

A different group of *Tibicen* that average somewhat larger than the fifteen species just mentioned, are the five that have, except in rare variations, the mesonotum decorated with two pipe-shaped marks that have been likened to the Hebrew letter resh inverted. They also pretty regularly have a dorsal row of spots on the abdomen. Of such species are *marginalis* Walker, and *resh* Haldeman, that occur in the central part of the United States and reach the Gulf of Mexico to the south; *dorsata* Say, that is slightly more western in distribution, and occurs southward to Texas; *dealbata* Davis, still more western, occurs from Montana and North Dakota southward to New Mexico and Texas, and lastly *cultriformis*, Davis, a large species, that thus far is known only from eastern Arizona.

The remaining eight species of *Tibicen*, namely *inauditus* Davis, *tigrina* Davis, *townsendi* Uhler, *bifida* Davis, *duryi* Davis, *parallela* Davis, *chiricahua* Davis, and *longiopercula* Davis, are all confined to the southwestern states, and are smaller than the five just considered. The first five of this group are known to reach Texas on the east; *parallela* and *chiricahua* are recorded from New Mexico and Arizona, while *longiopercula* is known only from Arizona. It is among these last mentioned insects, which in most of the species have the sides of the body conspicuously parallel to each other, especially in the males, and which are also generally black with orange or reddish markings, that the greatest resemblance occurs to *plebeja* Scopoli of the old world, the type of the genus *Tibicen*.

The seventeen species of *Diceroprocta*, with the exception of *viridifascia* and *vitripennis*, are confined to the southern states, many of them extending into Mexico. *Diceroprocta viridifascia* Walker, *olympusa* Walker, *marevagans* Davis, and *bicornica* Walker, are found along the Atlantic coast, or that of the Gulf

of Mexico; *cinctifera* Uhler, *vitripennis* Say, *bequaerti* Davis, *texana* Davis, *bibbyi* Davis, *delicata* Osborn, and *azteca* Kirkaldy, occupy the general region of the Mississippi or some part of Texas, with an extension westward along the Rio Grande of *cinctifera*; *arizona* Davis, *knighti* Davis, *swalei* Distant, *semicincta* Davis, *apache* Davis, and *eugraphica* Davis, occur west of the 100th meridian, except for the slight extension eastward of the last mentioned species.

In the genus *Cacama* there are five species sometimes called "Cactus Dodgers" from their habit of hiding behind the broad parts of these spiny plants upon the approach of danger. All of the species inhabit the southwestern states, often extending into Mexico, where there are at least four additional species of the genus. *Cacama valvata* Uhler, *variegata* Davis, and *dissimilis* Distant, reach as far eastward as Texas, while *californica* Davis, and *crepitans* Van Duzee, have thus far not been recorded east of southern California.

Cicada hieroglyphica Say, occurs from Long Island, N. Y., to Florida and westward to Kansas and Oklahoma; *Cicada chisos* Davis, has been reported from Texas and Mexico. *Proarna venosa* Uhler, occurs from Nebraska and Colorado southward into Arizona and Texas; *Pacarina puella* Davis, in Louisiana, Oklahoma, Arizona and Texas southward into Mexico, while *Tettigades mexicana* Distant, extends northward from Mexico into Cochise County, Arizona, from which locality several specimens have been recorded.

The famous *Quesada gigas* Olivier, with its shrill song sometimes likened to a steam whistle, extends from southern Texas southward to Argentina, South America. It is known as the "Soup Bug," because about sun-down, when it is active and noisy, it sometimes flies to light, and lands among the supper dishes.

Up to this point we have in a general way considered the distribution in the United States of about fifty-seven species belonging to nine genera, the males of which can protrude the uncus from, or withdraw it into the abdomen. In the genera *Okanagana*, *Tibicinoides*, *Okanagodes*, *Clidophleps*, *Platypedia* and *Neoplattypedia* the uncus cannot be withdrawn to like extent by

the males into the abdomen, and is protected by being dropped into the valve or hypandrium. This character furnishes an easy method of separating the genera of North American Cicadas into two series. The genus *Melampsalta*, in which the uncus can be withdrawn into the abdomen, is generally placed at the end of the series, on account of venational characters, but it probably would be better placed near *Proarna* and *Pacarina*.

Okanagana rimosa Say, has the greatest known east and west distribution of any cicada in North America. It occurs from Nova Scotia to British Columbia and south to New York, Pennsylvania and Nevada. *Okanagana canadensis* Provancher, occurs from New Brunswick to Alberta and southward to New York, Pennsylvania and Colorado. *Okanagana balli* Davis, is a species sometimes common in Iowa and neighboring states, and as far west as Kansas and Montana; *synodica* Say and *hesperia* Uhler, occur from Montana and Kansas westward to the Rocky Mountains and southward to Utah, Arizona and Texas, while *Okanagana viridis* Davis, the only species so far known from the southeastern states, occurs in Mississippi, Arkansas and Tennessee. *Okanagana bella* Davis, has a wide distribution, occurring from Alberta, Kansas, New Mexico and Utah westward to California and British Columbia; *O. occidentalis* Walker, is slightly more northern in its distribution, occurring from Montana and Manitoba to British Columbia and the mountains of California. The remaining thirty-two species are to be found west of the Rocky Mountains, and no less than twenty-two species of the genus are known to be natives of California.

Of *Tibicinoides*, with proportionally shorter marginal areas in the fore wings than in *Okanagana*, there are three species, namely *cupro-sparsus* Uhler, *mercedita* Davis, and *minuta* Davis, all of which are so far known only from California.

The pale colored *Okanagodes gracilis* Davis, is found in California, Arizona and Utah. The uncus in this prominent-eyed species, with a narrow pronotum, is shaped as in *Clidophleps*, though in venational characters it resembles *Okanagana*, except that it usually has five marginal areas in the hind wing instead of six.

As far as at present known *Clidophleps wrighti* Davis, *blaisdelli* Uhler, *distanti* Van Duzee, *pallida* Van Duzee, *vagans* Davis, *tenuis* Davis, are confined to the state of California, while *astigma* Davis, occurs over the line in Lower California.

The next genus is *Platypedia*, and so far all the records are from west of the Mississippi. There are twelve known species and three that are here recorded as geographic races of *putnami*, but which may be species. The forms are as follows: *mohavensis* Davis, from Colorado, New Mexico, Arizona and Utah; *areolata* Uhler, Montana, Idaho, Utah, British Columbia, Washington, Oregon, California; *falcata* Davis, western Texas near the Rio Grande; *latipennis* Davis, Colorado; *putnami* Uhler, Nebraska, Colorado, Utah, New Mexico, Nevada, California; race *occidentalis* Davis, California, race *lutea* Davis, South Dakota, Montana, Utah to Arizona; race *keddiensis* Davis, California, Oregon; *vanduzeei* Davis, California, Nevada; *minor* Uhler, California, Nevada, Colorado; and *rufipes* Davis, *similis* Davis, *aperta* Van Duzee, *laticapitata* Davis and *barbata* Davis, all from California.

Neoplatypedia, in which the costal margins of the fore wings are suddenly bent and the end of the uncus upturned, is represented by two species, *ampliata* Van Duzee, found in Oregon and California, and *constricta* Davis, from Colorado, Utah, Arizona, Idaho and California.

It has already been stated that the genus *Melampsalta* might be placed to advantage near *Proarna* and *Pacarina*, or at least preceding *Okanagana*, instead of being at the end of the series. This large genus of many species is represented in North America, as far as known, by the following: *Melampsalta calliope* Walker, from Virginia to Georgia and westward to Colorado and Texas; variety *floridensis* Davis, in Georgia and Florida; *kansa* Davis, from Kansas, Colorado, Oklahoma and Texas, and *camerona* Davis, from southeastern Texas.

All the cicadas here mentioned have been considered in papers appearing in this JOURNAL since March, 1915. At that time very little could have been written concerning the distribution of the species, a great many of which were unknown. In a few years it is hoped that a satisfactory annotated list of the North American cicadas can be made, that will give in more de-

tail the distribution of the species of which we have here attempted a brief outline.

For the specimens upon which the following notes are based, the writer is chiefly indebted to Dr. Raymond H. Beamer and the University of Kansas. Dr. Beamer sent me for examination nearly nine hundred specimens during 1929. Mr. George P. Engelhardt has collected many during his travels in the western states, while I am also indebted to Dr. John W. Sugden, of Salt Lake City, Prof. Vasco M. Tanner, of Provo, Utah, and to Mr. H. B. Parks, of San Antonio, Texas. Mr. Howard H. Cleaves, of Staten Island, has collected many cicadas for me in the past and secured the Grand Cayman Island specimen while on the "Pinchot South Seas Expedition of 1929." Mr. W. E. China has, as usual, been very kind in making comparisons in the collection of the British Museum.

***Tibicen robinsoniana* Davis.**

Originally described from Virginia in this JOURNAL for March, 1922, this species was recorded from Missouri in the March, 1923, number, page 7, and from Tennessee in the June, 1926, number, page 177. On the fourth of September, 1928, Mr. A. E. Brower collected a male at Forsyth, Missouri, which he has kindly presented to me.

***Tibicen resh* Haldeman.**

In 1853 Prof. S. S. Haldeman described this species from Utah, as noted in this JOURNAL for 1915 and 1918, where some account of it will be found. It received its specific name because the spots on the mesonotum are shaped like the Hebrew letter resh but inverted. Several other species of cicadas, notably *marginales*, *dorsata dealbata*, and *cultriformis*, also have the inverted resh marks on the mesonotum. Several hundred specimens of *resh* have been examined and almost without exception the resh marks are present.

In 1916 Dr. R. H. Beamer kindly let me examine eleven males and nineteen females that were very dark in color, collected in Elk County, Kansas, in August of that year. One of these, a

female, was without any sign of the usual resh marks on the mesonotum. In 1921, Miss M. McGill sent me two males collected at Sulphur, Oklahoma, in July, 1921, that were without the resh marks, and in 1923 Beamer and Lawson collected a number of *resh* in southeastern Kansas in July and August, among them several very dark individuals. A female from Wilson County, Kansas, August 2, 1823, is without the resh marks on the mesonotum.

While Prof. Haldeman thought the cicada he described was collected in Utah by the Stansbury expedition, it probably came from Texas along with some of his other specimens. *Tibicen resh* is known to occur in Alabama, Mississippi, Louisiana, Missouri, Kansas, Oklahoma and Texas, in which last state it is at times very common, but no specimens have been examined from Utah, and Dr. John W. Sugden, of Salt Lake City, has so far been unable to find it, or any of its immediate allies near that city. *Tibicen dorsata* Say, and *Tibicen dealbata* Davis, reach the Rocky Mountains and may ultimately be found in Utah, for they have even a more westerly distribution than *Tibicen resh* is known to have at present.

Mr. Perry A. Glick has kindly sent me a male *resh* taken in the Glick Airplane Insect Trap at Tallulah, La., August 30, 1926, at 7:30 P. M., elevation 200 feet. In 1922, and again in 1923, Miss Louise Knobel collected this species at Hope, Arkansas, chiefly in July and August, at light. Some came to a light trap near woods, one, a male, as late as September 6, 1922.

***Tibicen inauditus* Davis.**

This species was described and figured in this JOURNAL for December, 1917, from northwestern Texas, and further records were given in this JOURNAL for 1926, page 179, and 1927, page 376. A male has been received from the Chisos Mountains, Brewster County, southwestern Texas, collected June 22, 1929. The species is now known from Texas, New Mexico, and Oklahoma.

Tibicen duryi Davis.

This gayly colored and handsome species has been recorded in this JOURNAL for December, 1917, and March, 1921, from Colorado, New Mexico and Arizona. It also occurs in Texas and Utah as appears from the following records: Davis Mountains, Jeff Davis County, 8,000 feet, Texas, five males and one female, June 20, 1928 (O. C. Poling). Chisos Mountains, Brewster County, 7,000 feet, Texas, male and female, June, 1929, and Boquillas, Brewster County, Texas, two females, June 24, 1929 (H. B. Parks). St. George, Utah, 1928 (Dr. John W. Sugden collection); Zion National Park, Utah, August 12, 1929, two males, one female (Dr. Raymond H. Beamer, University of Kansas).

Dr. Beamer also collected *duryi* in Coconino County, Arizona, and in McKinley County, New Mexico, in June and July, 1929, while Mr. George P. Engelhardt collected a male at Estancia, Torrance County, New Mexico, July 8, 1929. An additional Colorado record is a male from Fremont County, 1913 (J. Sinden).

Diceroprocta cinctifera Uhler, variety *viridicosta*. New var., Pl. VIII, fig. 1.

Type male and female allotype from Hidalgo County, Texas, August 14, 1928 (Dr. Raymond H. Beamer). Collection University of Kansas.

Diceroprocta cinctifera Uhler, was originally described from New Mexico, and it and nearly related forms are described in this JOURNAL for March, 1921; March, 1925, and December, 1928. Tables have been given for their separation, and of *cinctifera* Uhler it was stated that the opercula have the outer edges nearly parallel to each other; 8th segment and middle base of tergum pruinose. It may be added that the dark stripe running lengthwise of the abdomen beneath, is bounded each side in the male by nearly parallel pruinose areas, which do not occur in *apache*. In typical *cinctifera* the costal margin of the fore wings is colored bright orange to the end of the radial cell.

Numerous typical specimens having these characters have been examined from Bernalillo County, New Mexico, also from Dona Ana County, New Mexico, the type locality, and from along the Rio Grande in Texas from El Paso, Presidio, Castolon, Boquillas, Del Rio, and to Eagle Pass in Maverick County, in all a distance of about six hundred and fifty miles. In sending six males and one female collected at Boquillas, 750 feet, Brewster Co., June 24, 1929, Mr. H. B. Parks wrote that the cicadas emerged from the narrow river bank on the north side of the Rio Grande, and that the willows along the river were white with the cast shells of the pupæ.

Below Eagle Pass the altitude is about six hundred feet or less, and all the way to the coast, a distance of about three hundred miles, there is found a variety of *cinctifera* that owing to its great difference in color appears like a distinct species. It is, however, a variety or geographic race, with the collar green or greenish, the costal margin of the front wings green to the end of the radial cell, the subcostal vein almost black and the anal areas of all of the wings in part pale gray or straw-colored. In typical *cinctifera* the collar and front margins of the fore wings are conspicuously bright orange in color, as has been stated. The typical form and the race are alike in having the same areas pruinose.

We propose for this variety, or geographic race, the name of *viridicosta*. Numerous examples of this form were collected by Dr. Raymond H. Beamer and his associates from the University of Kansas, in July and August, 1928, as follows: Hidalgo County, thirty-one males and four females; Starr County, one male, and Cameron County one male. Other specimens have been examined, and we have a *viridicosta* labeled Eagle Pass, and also a *cinctifera* supposed to be from the same locality.

Diceroprocta cleavesi new species. (Pl. VIII, Figs. 2-3.)

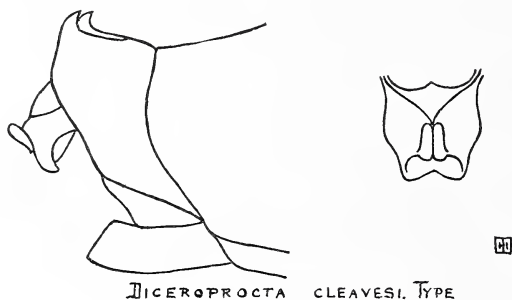
Type male from Grand Cayman Island, British West Indies, April 17, 1929 (Howard H. Cleaves collector). Davis collection.

Resembles *Diceroprocta bonhotei* Distant, from the Bahamas, but differs in having the opercula with the outer sides more nearly parallel to each other, and in the pattern of the pruinose areas. It still more closely resembles *Diceroprocta biconica* Walker, of Cuba, but differs in the pruinose areas, and in having the extreme base of both pairs of wings deep orange instead of greenish as in *bonhotei* and *biconica*.

Head with the front produced and eyes prominent, as in *bonhotei* and *biconica*, the black or almost black areas on the head, pronotum and mesonotum also following the same pattern, the collar pale brownish-green. The front margin of the fore wings greenish orange to end of radial cell; deep orange where the wings join the body; inner anal areas smoky gray; marginal areas slightly clouded. Abdomen with the base, sides, and extremity pruinose, leaving centrally an ovoid, brown colored area. Beneath mostly pruinose, with the opercula pale greenish and having the outer sides almost parallel to each other, the extremities not as rounded as in *bonhotei*. The inner basal portions of the opercula just meet whereas in *biconica* and *bonhotei* they usually overlap slightly. Centrally the abdomen is pale brown; pruinose at sides.

MEASUREMENTS IN MILLIMETERS

	Male Type
Length of body	32
Width of head across eyes	13
Expanse of fore wings	95
Greatest width of fore wing	14
Width of opercula at base	8
Greatest length of opercula	9



DICEROPROCTA CLEAVESI. TYPE

A photograph of the specimen here described from Grand Cayman Island, was sent to the British Museum, and comparisons were kindly made by Mr. W. E. China. He wrote that:

"The distribution of the white pruinosity which is well preserved in our specimens is exactly the same as in yours. The dorsal spine at the tip of the abdomen in the female is bent slightly upwards as in *bonhotei*." He found also that the last ventral segment in the female of *cleavesi* had the central notch more deeply cut than in *biconica*. From the drawing kindly furnished by Mr. China, this would also appear to be the case in comparison with *bonhotei*.

In this JOURNAL for December, 1928, there is an account of many of the cicadas belonging to the genus *Diceroprocta* with a table for their determination, and under *Diceroprocta biconica* Walker, is the statement that it is rather poorly figured in "Genera Insectorum," Plate 4, Fig. 24, 1912. This figure we now find represents the pattern of pruinosity found in the Cayman Island species, or sub-species, as will be noted by comparison with the figure of the type here presented, and also as gathered from the notes furnished by Mr. China. In the numerous *bonhotei* examined the pruinose areas have been conspicuous only at the base of the tergum between the tympana, and on the last two segments. In fresh examples of *biconica* from Cuba, the pruinosity is more extended and often includes the terminal half of the tergum, leaving the brown, central area, small, and of irregular shape. In the original description of *biconica* in 1850, Walker states: "Body ferruginous above, tawny and powdered with white beneath, partly covered with pale yellow shining down." This is an accurate enough description for many of the specimens, especially old examples. However, even in rubbed individuals the one-time pruinose areas are usually discernible.

***Diceroprocta marevagans* Davis. (Pl. VIII, Fig. 4.)**

Shortly after the description of this species appeared in this JOURNAL for December, 1928, Dr. Raymond H. Beamer sent me twenty-eight males and sixteen females for examination, collected by himself and associates in southeastern Texas near the coast, in Aransas, Victoria, and Brazoria Counties, from August 6 to 9, 1928. The female from Aransas County here figured

has a shallow notch at the extremity of the last ventral segment, and on each side of the notch the margin of the segment is slightly produced.

Dr. Beamer has also sent two males and one female collected at Tampico, Mexico, by W. F. Lynn, June and July, 1928. This extends the range about four hundred miles to the south.

All of these specimens closely resemble the type; the maculations on the fore wings are also the same.

Diceroprocta bibbyi Davis.

This species was described from seventeen specimens collected near Langtry, Valverde County, Texas, in July, 1928, and was figured in this JOURNAL, December, 1928.

Mr. H. B. Parks has sent me a male collected about one hundred miles further up the Rio Grande in the Chisos Mountains, Brewster County, Texas, June 22, 1929.

Diceroprocta bibbyi may at first sight be confused with *Diceroprocta knighti*, but it has a very differently shaped uncus figured as cited above; the first and second crossveins of the fore wings are unclouded, and in addition its general color is much darker, being almost black instead of chocolate brown.

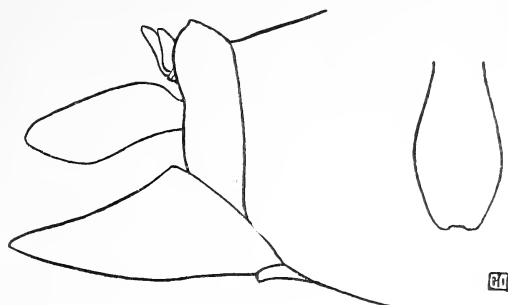
Cicada chisos Davis.

Since this species was described and figured in this JOURNAL for March, 1916, from Texas specimens taken in June, 1908, and in collection U. S. National Museum, Mr. George P. Engelhardt has collected two males at Alpine, Brewster County, Texas, June 7, 1927, and I have received through Mr. H. B. Parks, twelve males and four females collected in the Chisos Mountains, Texas, June 22, 1929. It also occurs in Mexico.

Okanagana schaefferi sub-species tanneri, new sub-species. (Pl. VIII, Fig. 5.)

Type male from Woodside, Utah (James Kartchner), Davis collection, and paratypes in the collection, Brigham Young University, Provo, Utah.

This showy black and pale straw-colored insect resembles *Okanagana schaefferi*, but the color pattern is quite different.



OKANAGANA TANNERI. TYPE

Head narrower than the front margin of the pronotum; front considerably produced and prominent. Median sulcus of the front well defined. Pronotum with the humeral angles rounded, the anterior angles prominent and the sides wavy or uneven and considerably amplified. Last ventral segment with the sides converging toward the extremity, which is more fully rounded out than in *gibbera*, where it is often shallowly notched, and than in most specimens of *schaefferi*, where it is somewhat truncate. Uncus black with a pale dorsal line. When viewed from behind, with a shallow notch at the extremity. The valve extends slightly beyond the uncus, and is pale straw colored. Fore wings moderately broad, and about as in *schaefferi*, with the costal margin pale straw colored almost to the end of the wings, where it is slightly darkened. Basal cell opaque with the surrounding veins pale, causing the central dark portion to be, by contrast, even more conspicuous. The venation is pale yellowish or straw-colored nearly to the marginal cells, where it is pale brown. Both pairs of wings at base, as well as the anal membranes, are pale straw-colored. The fore wings have the usual dark marks at the extreme base, while in the hind wings the pale straw-colored area at base is outwardly margined in places with fuscous.

Head pale with a broad interrupted black band, in which the ocelli are included, connecting the eyes; also black behind the eyes. Pronotum black, with the collar, side margins, two large irregular spots, one each side of the central line, pale. This pattern differs very greatly from either *schaefferi* or *gibbera*, in which the pronotum, except the margins, is generally all black. Mesonotum black, the posterior margin, the elevated X and connecting spots together with the posterior extremities of the obconical marks pale; also pale straw-colored each side at the base of the wings. Metanotum margined posteriorly with pale straw-color. Tergum black with the segments margined posteriorly with pale straw-color, segments 8 and 9 about one half pale. Beneath pale; five segments narrowly black at the

base. Legs pale variegated with black with about the basal half of the fore femora black, the remainder straw-colored. In *schaefferi* the fore femora are black except at the extremities.

MEASUREMENTS IN MILLIMETERS

	Male Type
Length of body	28
Width of head across eyes	7
Expanse of fore wings	68
Greatest width of fore wing	12
Length of valve	4.5

In addition to the type, three male paratypes collected at the same place and probably at the same time, have also been examined. They are in the collection of Brigham Young University, Provo, Utah, and one was collected by Prof. Vasco M. Tanner, who has also sent me other cicadas.

Okanagana rimosa Say.

There seems every reason to believe that this species, known to occur in the Highlands of the Hudson, is to be found living on the coast as far south as Long Island, New York, though up to date the only specimens collected have been those found in the wash-up on the beach of the south shore. The record now stands: Rockaway Beach, June 26, 1909, female (George P. Engelhardt); Rockaway Beach, June 14, 1914, female (Ernest Shoemaker), and Long Beach, June 27, 1926, female (Alfred J. Kistler).

Mr. Kistler wrote of this last specimen that it "was found to the best of my recollection with some faint signs of life. . . . The exact locality should be Lindo Beach, a mile or so further out from Long Beach proper."

This species has a wide range in the north extending from Nova Scotia and New Brunswick to Michigan, Wisconsin, Illinois, Iowa, Minnesota, North and South Dakota, and Manitoba. We also have records, supposedly of this species, from Fraser Mills, British Columbia, and from Idaho, Nevada and the mountains of California, but further specimens should be examined from the extreme western part of the range beyond the Rocky Mountains.

***Okanagana canadensis* Provancher.**

Like *Okanagana rimosa*, mentioned above, this species has a wide range in the northern part of North America. We have records from New Brunswick, New Hampshire, Pennsylvania, Ontario, Michigan, South Dakota, Colorado, Manitoba and Alberta.

The Alberta records are two males collected at Edmonton, June 16, 1916 (Prof. F. S. Carr), and three males and one female, also from Edmonton, June 5 to 14, 1925 (Owen Bryant). The Royal Ontario Museum of Zoology, Toronto, contains a number of specimens from Lake Nipigon, Macdiarmid, and various other parts of that province, many of them collected by Norman K. Bigelow. In the Annual Report of the Entomological Society of Ontario for 1922, page 38, Prof. Lawson Caesar records a brood of this species on Manitoulin Island, Lake Huron, June 16, 1922. He states that seventy-five of the cast pupa skins were counted on or close to a single poplar tree (*Populus tremuloides*), and that the greatest volume of sound appeared to come from the part of the woods where poplars were most abundant.

On June 21, 1887, Mr. E. J. Oslar collected a female of this species at Strontia Springs, Douglas County, Colorado. This, with *Okanagana gibbera*, described in this JOURNAL for 1927, page 379, adds two additional species to the twenty-three mentioned in the annotated list of the Cicadas of Colorado published in March, 1921. Also from Colorado is *Okanagana bella* var. *rubrocaudata*, described in this JOURNAL, March, 1925.

***Okanagana striatipes* Haldeman.**

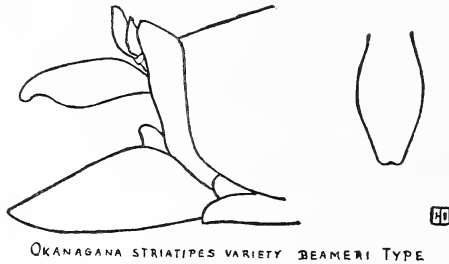
In Stansbury's Exploration and Survey of the Valley of the Great Salt Lake of Utah, 1853, p. 369, S. S. Haldeman described *Cicada striatipes*. He states that the wings expand nearly two inches (23 lines); that it is "black above varied with a little yellow; beneath yellow"; hypostoma prominent; "tergum black with the apex and margins of the segments yellow, elytra and wings with the nervures yellowish-white; those of the exterior cells blackish; the basal portion, which is doubled beneath in repose is orange." In the writer's collection there are 37 speci-

mens from Utah, collected at Salt Lake City by Dr. J. W. Sugden, at Stockton and Eureka by Mr. Tom Spalding, and in Iron County by Mr. Engelhardt, that agree with the description.

On July 1, 1929, Dr. Raymond H. Beamer and his associates on a collecting trip for the University of Kansas, found fifty-nine specimens of a dark form in Coconino County, Arizona, that is evidently closely related to *striatipes*, but at first sight looks something like *vanduzeei* from California in color and size. The head is much smaller and the front is more prominent, also the ventral surface is without the long hairs found not only in *vanduzeei*, but also in the related *consobrina* and *californica*. In color and vestiture it more closely resembles *Okanagana utahensis* Davis, but is very much smaller; the front of the head is not as prominently wedge-shaped, and the abdominal segments are margined posteriorly with orange. As there are connecting specimens, the form from Coconino County is here considered a dark colored variety of *striatipes*.

Okanagana striatipes variety **beameri**. New variety. (Pl. VIII, Fig. 6).

Type male and allotype female from Coconino County, Arizona, July 1, 1929 (Dr. Raymond H. Beamer). Collection University of Kansas.



Head slightly narrower than the front margin of the pronotum; front moderately produced and about as prominent as is usual in *striatipes*. Median sulcus of the front well defined for most of its length. Pronotum as in *striatipes*, with the humeral angles rounded and the anterior angles prominent. Last ventral segment constricted at the sides, then broadened out to the extremity, which has the outer angles rounded, and a shallow sinus centrally. Uncus when viewed in profile, hooked at the end; when

viewed from behind the hook is seen to be notched. The last ventral segment in the female allotype is broadly and doubly notched. In *striatipes* the inner notch is not as prominent, and in *uthensis* there is usually no inner notch. Venation of the fore wings fuscous; in several of the paratypes the veins surrounding the ulmar cells are straw-colored. Costal margin of fore wing yellow to end of radial cell, darker beyond; subcostal vein black, or nearly so. Basal cell clouded, blackened on the hind margin. A few of the paratypes have the subcostal vein pale and the basal cell clouded. Both pair of wings variegated with fuscous at base with the membranes orange red. In *striatipes* the hind wings are not as dark at base.

Head black with the grooves and supra-antennal plates testaceous; beneath with the median sulcus orange; rostrum black orange at base. Pronotum black; the grooves testaceous; bordered all round with orange but more narrowly on the anterior margin. Mesonotum black with the hind margin orange; the elevated X orange with a black spot on each of the fore limbs and four orange spots arranged in a semi-circle in front of the X, as in *striatipes* and *utahensis*. Metanotum black with the posterior margin orange. Tergum black with the segments margined posteriorly with orange. Uncus pale orange, blackened on sides. Beneath, the legs pale striped with black, and abdominal segments fuscous, each one edged with pale posteriorly. Valve pale.

MEASUREMENTS IN MILLIMETERS

	Male Type	Female Allotype
Length of body	19	19
Width of head across eyes	6	6
Expanse of fore wings	49	49
Greatest width of fore wing	8	8
Length of valve	2	

In individuals having the same expanse of wings, the fore wings, as a rule, are slightly narrower in *beameri* than in *striatipes*.

In addition to the type and allotype there are fifty-seven specimens in the lot, all collected in Coconino County, Arizona, on the first of July, 1929, by Dr. Beamer, Paul W. Oman, W. F. Lynn and L. D. Anderson. In the writer's collection there are two males from Flagstaff, Arizona, June 29, 1892, and two males from Bellevue, Washington Co., Utah, June, 1917, and July 7, 1917, collected by Mr. George P. Engelhardt.

Dr. Beamer writes concerning the fifty-nine specimens collected on July 1, that they were found eight miles north of Williams,

Arizona, on a sage brush flat; that the song was of fair duration, neither long nor short, and that they were also found east of Ashfork in sage brush along the roadside.

Okanagana hesperia Uhler.

A great many specimens of this species have been examined from Kansas, Oklahoma, Texas, Montana, Colorado, New Mexico, and Arizona which were alike in having the basal half or more of all of the wings infuscated, the first two or three segments of the abdomen dark, and with a median, dorsal row of dark spots on the remaining segments. The entire dorsum of the body may, however, in some specimens be so darkly colored as to appear almost black. In the writer's collection there are a number of this dark variety from Turkey Creek Canyon, Colorado, 7,500 feet, July, found in sage brush; one from near Hereford, Deaf Smith County, Texas, June 7, 1925, and a male and female collected at Jemez Springs, New Mexico, July 3, 1929, by Mr. George P. Engelhardt.

Okanagana pallidula Davis.

This species was described and figured in this JOURNAL for December, 1917, page 213, from the male type and nine paratype males collected at Athlone, Merced County, California, in July and August, 1917, by Alonzo C. Davis. In the original description it was stated that it was a yellowish or greenish-yellow insect, almost unicolorous, with the membranes at the base of the wings orange, and that at first glance, owing to its pale color, it had the appearance of being immature.

Nothing further was learned of the insect until a very much damaged female taken at Bakersfield, California, July 4, 1928, was received from Mr. R. F. Sternitzky. In the summer of 1929, Dr. Raymond H. Beamer of the University of Kansas and his assistant, Mr. Paul W. Oman, captured sixty-four specimens in California. On July 24 they took 32 males of the greenish variety, and 22 males and 2 females of the yellowish variety at Bakersfield. On August 6, Dr. Beamer took 2 males and one female of the greenish variety, and 4 males of the yellowish

variety at Merced, California, and on the same day a male at Winters, California. There has been no difficulty in separating the 64 specimens into the straw-colored and greenish forms or varieties.

One of the females has a median row of small and dark colored spots on the dorsum of the abdomen, except on segment nine, where there are two spots, one each side of the central line. The notch in the last ventral segment of the abdomen is simple in all of the females, being without the inner notch found in many species of *Okanagana*. These are the first females to be described of this very pale species, separated from *uncinata* Van Duzee, which it resembles, by its lighter color, larger size, and in having the third marginal area in the fore wings the length of the median area immediately adjoining it.

***Okanagana uncinata* Van Duzee.**

Mr. Van Duzee in the JOURNAL OF THE NEW YORK ENTOMOLOGICAL SOCIETY, March, 1915, stated that this species was described from two males taken by him on grass along the road five miles north of San Juan Capistrano, Orange County, California, June 25, 1914. But few specimens of *uncinata* have been examined by the writer. The following are the records:

Mokelumne Hill, Calaveras County, Calif., June, 2 males, Los Angeles Museum.

Lindsay, Tulare County, Calif., June 6, 1925, female (Stanley W. Bromley).

The female taken by Mr. Brumley has the notch in the last ventral segment simple, as it is in *Tibicinoides mercedita* Davis, which it resembles. The two species may be told apart by the marginal areas being much shorter in *mercedita*; the third one in the fore wings is about one half as long as the second ulnar area adjoining and immediately behind it. In *uncinata* the third cell is more nearly as long as the adjoining ulnar area.

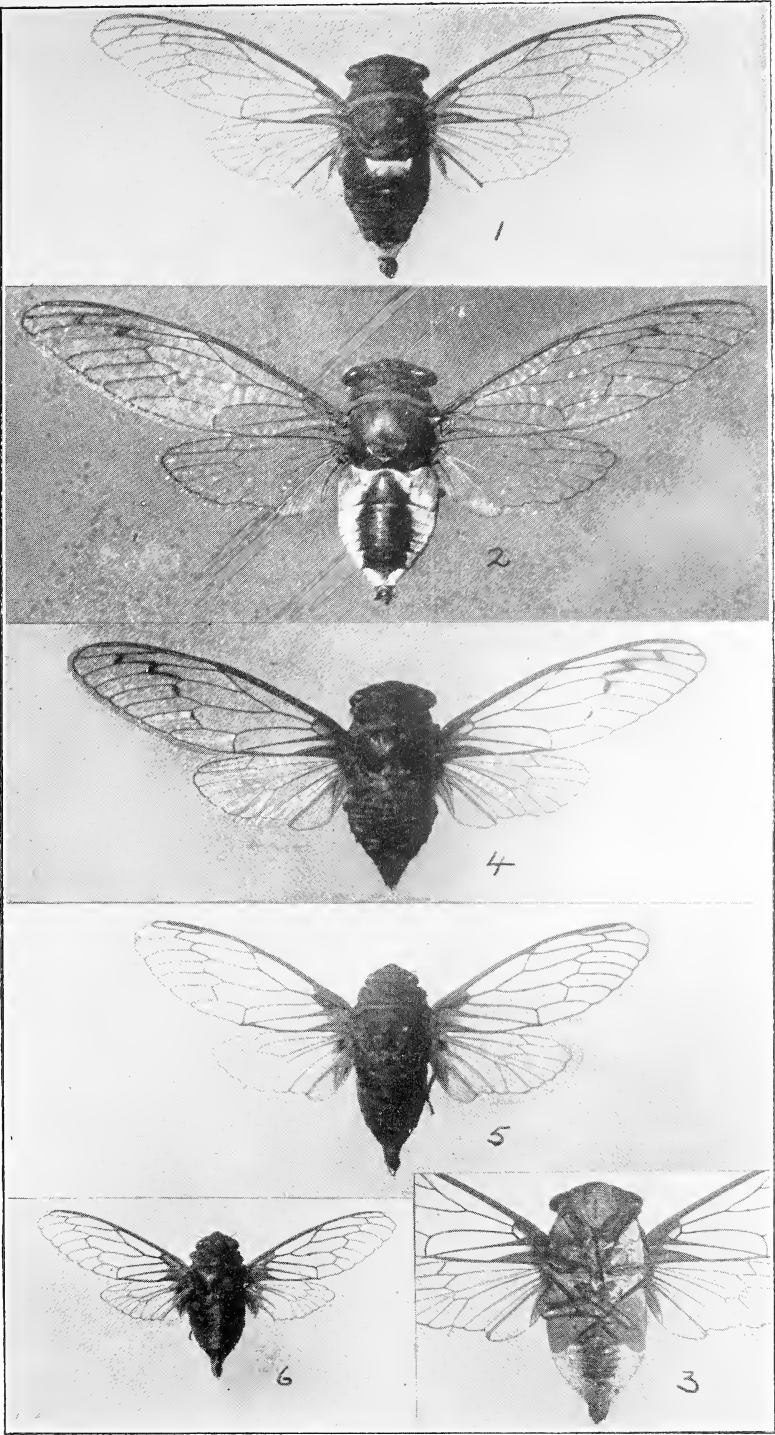
***Clidophleps vagans* Davis.**

This species was described and figured in this JOURNAL for March, 1925, from a single male found in an automobile, but

probably from the Owen's Valley region, California. In the December, 1927, JOURNAL, another male from Yosemite is recorded and figured. In 1928 Mr. F. H. Wymore of the Branch of the College of Agriculture, Davis, California, sent the following specimens found at Victorville, San Bernardino County, California: nine males and four females collected, June 29, 1927, and one male collected, July 27, 1927. The notch in the last ventral segment of the female is broad with a smaller central notch, and is of the form usual in *Clidophleps*.

PLATE VIII

- Figure 1. *Diceroprocta cinctifera* variety *viridicosta*. Type.
- Figure 2. *Diceroprocta cleavesi*. Type.
- Figure 3. *Diceroprocta cleavesi*. Under side of Type.
- Figure 4. *Diceroprocta marevagans* Davis.
- Figure 5. *Okanagana schaefferi* sub-species *tanneri*. Type.
- Figure 6. *Okanagana striatipes* variety *beameri*. Type.



CICADIDÆ

THREE NEW DIPTERA FROM CANADA

BY C. H. CURRAN.

The two tachinids described in the following pages had been set aside as new for several years, additional specimens of each coming to light at various times. Both evidently have a wide distribution in Canada and are apparently confined to the Canadian zone. The new *Hydrophorus* belongs to a very interesting group in which there are four or more postvertical bristles and pile on the pteropleura. There are several North American species with the pteropleura short pilose and at least three or four in Europe. Included with this species are many other dolichopids previously known only from Alaska indicating that the Arctic fauna is continuous in distribution around the northern coast of Canada proper at least as far east and south as the north shore of the Gulf of St. Lawrence.

*Dolichopidæ****Hydrophorus browni*, new species.**

Related to *intentus* Aldrich but the face is shorter and wider, the arista is shorter and much thicker, the anterior tarsi are two-fifths longer than their tibiæ instead of at least four-fifths longer and there is not the slightest indication of clouds on the posterior crossvein and apical section of the fourth vein. Length, 4 to 5 mm.

MALE. Face golden yellow; front brown, from anterior view golden brownish yellow; occiput grayish ochreous, the black bristles limited to the upper half. Beard yellow, some black bristles below the neck; four pairs of postverticals. Cheeks moderately wide, gray. Antennæ black, grayish pollinose; arista very thick, terminating in a distinctly separated hair-like point. Palpi black, gray pollinose and yellow pilose.

Mesonotum yellowish brown pollinose, with four slightly darker vittæ; from ten to fifteen dorsocentrals. Scutellum yellowish brown, with one pair of strong and several pairs of weaker bristles. Pleura ochreous-gray, paler below. Pteropleura with yellow pile; a single black bristle above the anterior coxæ.

Legs blackish or green, grayish-ochreous pollinose, the femora basally, and the coxæ more grayish. Anterior femora with two irregular rows of short, stout bristles beneath and usually with three or four isolated bristles above; anterior tibiæ with a row of six or seven very short, curved bristles

on the postero-ventral edge and with a row of shorter and finer closely placed bristles on the antero-ventral surface, the latter terminating in three stouter ones. Anterior coxæ yellow pilose, on their inner surface and the inner part of the posterior surface with scattered, short, stout spine-like bristles. Middle and posterior coxæ wholly yellow haired.

Wings strongly tinged with brown, the veins margined with darker brown; base of wing grayish hyaline, in some lights with whitish or milky tinge, especially a spot beyond the apex of the anal cell. Squamæ yellowish, the fringe paler. Halteres reddish yellow.

Abdomen thickly ochreous pollinose, yellow pilose on the sides and venter, the dorsum with coarser, appressed black hair.

FEMALE. Similar to the male but with a wider face, and more often lacking the bristle above the anterior coxæ.

HOLOTYPE, male, Bonne Esperance, Que., July 14, 1929 (W. J. Brown), in the Canadian National Collection.

ALLOTYPE, female, same data.

PARATYPES: male and four females, same data and male, Harrington Harbor, Que., July 4, 1929 (Brown).

The apical segments of the anterior four tarsi are shorter than in *intentus* and apparently more compressed laterally and wider. The two species look very much alike superficially but the differences are very evident when specimens are compared.

Tachinidæ

Cyrtophloeoba nitida, new species.

Differs from *coquilletti* Aldrich in having the abdomen shining black, with only about the basal fifth of the second to fourth segments whitish pollinose. Length, 6 to 7 mm.

MALE. Front three-fourths as wide as greatest width of eye, strongly widening anteriorly; eight pairs of frontals, all reclinate; four or five pairs of orbitals of which only one or two are strong. Frontal vitta as wide at the middle as parafrontal opposite, widest above, reddish in ground color. Head black, grayish white pollinose; soft part of cheeks reddish. Parafacials with four or five downwardly directed bristles and a few hairs. Palpi reddish. Antennæ reddish, the third segment black; arista black, thickened on basal two-fifths. Eyes short pilose.

Thorax shining black, the pleura and sides of the mesonotum in front cinerous pollinose; dorsum thinly grayish pollinose in some lights. Acrosticals and dorsocentrals 3-3; sternopleurals 2-1; four pairs of marginal scutellars the apical pair decussate, and a pair of sub-erect pre-apicals. Propleura bare; infrascumal setules present.

Legs black; wings tinged with gray, smoky along the costa except apically. Squamæ whitish. Halteres yellow.

Abdomen shining black, not more than the basal fifth of the segments whitish pollinose. Second and third segments each with a pair of discals, the fourth with two rows; second with pair of median marginals, the third and fourth with row.

FEMALE. Front as wide as eye; pollen of parafrontals with brownish-yellow tinge in the middle and inclined to appear shining above.

HOLOTYPE and ALLOTYPE, male and female, in coitu, Aweme, Man., May 21, 1921, (N. Criddle), in Canadian National Collection.

PARATYPES ♀, Aweme, May 6, 1920 (P. Vroom); ♀, Low Bush, Lake Abitibi, Ont., June 2, 1925 (N. K. Bigelow); 4 ♀, Hull, Quebec, May 18, 1927; ♀, Aylmer, Quebec, May 19, 1927, and ♀, Ottawa, Ont., May 23, 1927 (Curran). Paratypes in American Museum of Natural History.

***Meriania septentrionalis*, new species.**

Agrees with *puparum* Fabricius in having the parafacials haired but differs in color, etc. Length, 10 to 11 mm.

MALE. Head black, cinereous pollinose, the facial depression, inner border of parafacials and the soft part of the cheeks rusty reddish. Front as wide as either eye, projecting the width of the eye beyond the anterior border of eye; with eight to ten pairs of frontals, the lower two below the base of the antennæ; ocellar triangle black, with rather abundant hair, the ocellars long; outer verticals absent. Occiput with about three irregular rows of black hair and with pale yellowish pile. Cheeks and parafacials black haired, the former more than half as wide as eye-height. Vibrissal angles with numerous long bristly hairs, the vibrissæ somewhat stronger than the longest hairs. Palpi reddish. Antennæ black, the arista thickened on basal half.

Thorax black, with grayish pollen, the mesonotum in some lights appearing shining black with two incomplete grayish vittæ. Acrosticals 2-1; dorsocentrals, 3-3; posterior sub-lateral absent; sternopleurals, 2-1. Apical half of scutellum reddish; four marginals and usually a weak, decussate apical pair; a row of four to six bristles behind the middle. Propleura bare; infrascumal setules absent.

Legs black; pulvilli elongate, yellow. Wings grayish hyaline, the costal cell a little darkened; veins faintly clouded with brown, the crossveins conspicuously so; bend of fourth vein with very short appendage. Squamæ white with yellowish tinge. Halteres brown.

Abdomen shining black, the sides of the second and third segments usually broadly red basally; basal third or less of second to fourth segments

gray pollinose. First and second segments with pair of median marginals, the third and fourth with row; second and third segments with one or two pairs of discals, the fourth with one or two more or less complete rows. Posterior forceps fused as in *Ernestia*, the outer forceps elongate triangular as in that genus.

FEMALE. Front wider, with only six or seven pairs of frontals and with two pairs of orbitals.

HOLOTYPE: ♂, Vernon, B. C., April 28, 1924, (E. R. Buckell), in the Canadian National Collection.

ALLOTYPE: ♀, Creston, B. C., May 19, 1924, (C. S. Lallamand).

PARATYPES: ♂, same data as holotype; ♂, Medicine Hat, Alta., April 17, 1926, (F. S. Carr); 2 ♀, Low Bush, Ont., June 18, 1925, (N. K. Bigelow). Paratypes in American Museum of Natural History.

Superficially this species resembles *Ernestia fasciata* Curran but it is at once separated by the wider, haired parafacials.

PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY

MEETING OF MARCH 19, 1929

A regular meeting of the New York Entomological Society was held at 8 P. M. on March 19, 1929, in the American Museum of Natural History; President Wm. T. Davis in the chair, with twenty members and eight visitors present.

Mr. Barber spoke of "Collecting Experiences in California" with illustrations by specimens and views of the sections visited. He had started from New York on February 4, and after visiting in Lincoln, Nebraska, and a day at the Grand Cañon, had reached Altedena. From it as a center he had collected in the Arroyo Seco, where sifting gave the best results, especially where a growth of wild mustard on the flats made a cover for Coleoptera and Hemiptera. A day with W. S. Blatchley was memorable for its visit to the Pitch Beds, another was spent at the head waters of the cañon, where a male Belostomid, dorsally covered with eggs, was found. Palm Springs was also visited. Then two weeks with W. S. Wright at San Diego, with much collecting by pulling up grass clumps to find the insects clustered in the damper soil around the roots. After a visit to Imperial Valley two weeks were devoted to San Francisco with Van Duzee and Leach, including three days at the latter's bungalow in Mendocino County. The contrast between the redwood and madrone which clothed the hills and the desert of Southern California was great, and was accompanied by a different type of collecting. At last came the end of a three months' trip and the study of the material from which already new species have been described.

Mr. Barber's remarks were discussed by Mr. Davis, who said the Cicada found on Manzanita was *Okanagenia rubrovenosa*; by Mr. Bromley, who was interested in the *Triatoma protractus* found in rat's nests, because the species found in Florida, *sanguisuga*, is said to feed on human blood; and by Mr. Bueno, who discussed the habits of gerrids.

Mr. Barber said that all his specimens of *Macrovelia* were taken under boards in a low damp meadow. He spoke also of some observed resemblances of capsids and ants and of the abundance of box elder bugs.

Mr. Davis exhibited Circular No. 138 by Henry Fox on the *Dermaptera* and *Orthoptera* of New Jersey and pointed out its discussion of faunal zones in New Jersey.

Mr. Mutchler announced the sudden collapse of Mr. George W. J. Angell, who was the first president of the Society, and who died on March 22.

MEETING OF APRIL 2, 1929

A regular meeting of the New York Entomological Society was held at 8 P. M. on April 2, 1929, in the American Museum of Natural History; Presi-

dent Wm. T. Davis in the chair, with sixteen members and seven visitors present.

The president announced the death on March 22 of Mr. George W. J. Angell, a member of the Society since September 7, 1892, and its first president. On motion, duly seconded and carried, the secretary was instructed to forward an expression of the Society's regret and sympathy to his family.

Mr. Davis showed messages from Mr. Engelhardt, now in Florida, and Dr. Lutz in Panama, and exhibited also Dr. Needham's new book on Dragon Flies.

Mr. H. F. Schwarz gave an interesting account of "A Visit to Some European Entomological Centers," including London, Oxford, Paris, Germany and Switzerland. The principal purpose was the study of types of bees in the collections visited, but many details of insectivorous plants at Kew Gardens, of the invertebrate zoo, and of the European water spider, added to the interest of Mr. Schwarz' remarks.

Mr. C. H. Curran described "An Entomological Visit to Panama" with illustration by lantern slides. After showing the character of Barro Colorado, Mr. Curran exhibited photographs of some of the more remarkable Hemiptera, Orthoptera, and Diptera he had found.

In the discussion following his remarks, Mr. Schwarz said that eighteen species of honey bees were included in the material collected.

Mr. Bromley commented on the variety of trees shown, a condition similar to that found in Florida hammocks.

Mr. Angell recorded *Ceruchus piceus* found March 16 at Cook's Falls, N. Y.

Mr. Davis recorded *Cicindela repanda* seen March 24 at Fertile Plain, N. Y. He also recorded three specimens of *Okanagana rimosa* Say, all found in the wash-up on the Long Island shore, as follows:

♀ Rockaway Beach, Long Island, N. Y., in wash-up, June 26, 1909 (Geo. P. Engelhardt).

♀ Rockaway Beach, Long Island, N. Y., in wash-up, June 14, 1914 (Ernest Shoemaker).

♀ Long Beach, Long Island, N. Y., in wash-up, June 27, 1926 (A. Kiestler).

He also said no living specimens had been found on Long Island.

MEETING OF APRIL 16, 1929

A regular meeting of the New York Entomological Society was held at 8 P. M. on April 16, 1929, in the American Museum of Natural History; President Wm. T. Davis in the chair, with fourteen members and ten visitors present.

Mr. V. I. Safro, 40 West 77th St., New York, was elected a member of the Society.

Mr. J. L. King made an address, illustrated by lantern slides, on "Parasite Work at the Japanese Beetle Laboratory" in which he described the preliminary studies of parasites, followed by a description of methods of transportation to the Laboratory and of breeding there. His remarks displayed a thorough knowledge of the subject, and were followed with great interest by the members.

In the discussion that followed Mr. Bromley spoke of the predatory work of Asilidæ, and the president congratulated and thanked Mr. King.

Mr. Schoof, present as a visitor, exhibited some remarkable insects from New Guinea.

Dr. Lutz gave a preliminary account of his recent studies of leaf-cutting ants at Barro Colorado in the Panama Canal Zone.

Mr. Engelhardt told of his visit to Florida, where he had met Mrs. E. Robertson-Miller, Prof. Fernald, Dr. Blatchley, and Mr. Frank Morton Jones. His own studies had been principally on clear-wing moths.

MEETING OF MAY 7, 1929

A regular meeting of the New York Entomological Society was held at 8 P. M. on May 7, 1929, in the American Museum of Natural History; President Wm. T. Davis in the chair, with nineteen members and five visitors present.

Communications from Mr. Notman in Alabama and from E. B. Williamson were read.

Dr. H. L. Dozier, Entomologist of the Delaware Agricultural Experiment Station, spoke of his "Studies on Aleyrodidæ and Fulgoridæ" with illustrations by microscopic specimens and photomicrographs. He made an informative address, dwelling especially on the structure of the pupa case as the basis of classification in the Aleyrodidæ, and the economic importance of the greenhouse white fly in this latitude. The waxy secretions also were discussed and the origin of the name lantern fly for Fulgeroids.

His remarks were discussed during the meeting by Dr. Lutz and Messrs. Davis, Weiss, Engelhardt and Mutchler.

After adjournment Dr. Dozier exhibited specimens under the microscope.

Mr. Huntington exhibited a rare *Thecla wittfeldii* from Florida.

Mr. Angell exhibited *Cremastochilus* from North Carolina and the resemblance of a longhorn beetle with certain ants.

Mr. Davis gave April 30 as the date of the first *Papilio* this year, a large ♂ *turnus*, and May 5 as the date for the first *P. troilus*.

Mr. Nicolay spoke of *P. ajax* at Washington, D. C.

Mr. Engelhardt had found *Paratenedera sinensis* egg masses at Queens, Long Island.

Mr. Angell recorded *Carabus serratus* at Cook's Falls, N. Y.

Other interesting finds were spoken of—*Panagæus* by Mr. Shoemaker—roaches in places warmed by underground fires by Messrs. Ragot and Davis, and *Ceutorhynchus* and *Bruchus* by Mr. Leng.

MEETING OF MAY 21, 1929

A regular meeting of the New York Entomological Society was held at 8 P. M. on May 21, 1929, in the American Museum of Natural History; President Wm. T. Davis in the chair, with fifteen members and seven visitors present.

In the absence of Mr. Leng, Mr. Sherman acted as secretary.

Mr. Joseph J. Copeland was elected to membership in the Society.

Miss Elizabeth Sherman, of Mount Vernon, N. Y., and of the class of 1929 at Smith College, was proposed for membership by her father, John D. Sherman, Jr., and on motion by Mr. Mutchler, duly seconded, the by-laws were suspended and the secretary was instructed to cast a ballot for her immediate election to membership in the Society.

The president read a card from Mr. Notman dated at Liberty, Texas, May 5.

Mr. Nicolay spoke on "Recent Experiences in Collecting Coleoptera," before which he placed on exhibition a box containing specimens of Ulodiini, a tribe of Buprestidæ peculiar to the old world, the species of which look like lamellicorn beetles, and in their buzzing flight are suggestive of cetonid beetles and bees. The tribe abounds in Africa and several species of the Cape Town region have heavy tufts of hair on the elytra. Species from the East Indies and Malay Archipelago are brilliantly colored.

Mr. Nicolay began his remarks with an enthusiastic account of the fine species of *Bembidium*, *Elaphrus cicatricosus*, and other Carabidæ to be found in the New Jersey region variously labeled by Shoemaker as Montvale, by Quirsfeld as Rivervale, and by Nicolay as Orangeburg; also of the occurrence at Terrace Pond, N. J., of *Pterostichus pennsylvanicus* and other boreal species, and *Buprestis salisburyensis* and of *B. sulcicollis* taken, the latter from healthy pine trees, on the hill summits around River Forest in the Greenwood Lake section, in May and June.

He then took up the matter of his hardships in the vicinity of and on Mount Washington, N. H., which he ascended with Mr. Quirsfeld from the Glen House via the Carriage Road, Raymond Path, and Tuckerman's Ravine, finally reaching after somewhat normal experiences the Lakes of the Clouds huts. No specimens of *Blethisa julichii*, which has been found in the vicinity of these Lakes, were found, and the acting secretary got the impression that the speaker wished it placed on record that he paid a five spot to be safely conducted to the carriage road by one of the "hut boys" from this benighted spot.

Mr. Nicolay admitted that *Bembidium lucidum*, *Elaphrus olivaceus* and other nice carabids occurred along the Peabody River; also that he found Mount Madison a much more friendly mountain than Mount Washington, finding on Madison *Sphaeroderus brevoorti*, *Nomaretus bilobus*, and other good Carabidæ. The flat plateau of Carter Dome also furnished numerous specimens of the gregarious *Notiophilus nemoralis*, a brown species, occurring among the pine needles and not requiring sunlight for its activity.

Mr. Nicolay found his honeymoon trip to Bermuda in December a little less difficult than the White Mountain ordeals, but failed to enthuse over the sea voyage and collecting in Bermuda, where the flora was much more interesting than the fauna.

Mr. Angell spoke of his recent trip to Elizabeth City, N. C., with his daughter. In this vicinity he found *Carabus vinctus* var. *carinatus*, many *Cremastochilus*, *Cicindela tranquebarica* var. *minor*, also two dead specimens of a fine *Cychrus*.

An extraordinarily large rattlesnake, at first mistaken for a woodchuck or allied mammal, was seen.

On the return trip Mr. Angell stopped in Washington, where he examined the Casey Lucanidæ, and he gave his opinion, with drawings, of the three species of *Platycerus*—*keenii*, *thoracicus*, and *pedecellaris*.

Mr. Davis exhibited a box of Utah specimens of *Okanagana* consisting of four species, one new, and all somewhat closely resembling each other, as species of this genus from a given locality are apt to do.

Mr. Lemmer stated that night collecting of moths had not, so far this spring, been very productive.

MEETING OF OCTOBER 1, 1929

A regular meeting of the New York Entomological Society was held at 8 P. M. on October 1, 1929, in the American Museum of Natural History; President Wm. T. Davis in the chair, with seventeen members and seven visitors present.

Mr. Hall submitted the treasurer's report, which was received with thanks.

The secretary submitted a proposal from the New York Academy of Sciences to publish a new directory, the proportionate expense to the Society being about \$22, which was approved.

Dr. Felt spoke of the death of Dr. Frank H. Chittenden on September 15, 1929, and of his long period of service in the Department of Agriculture. The president recalled his editorial work on *Entomologica Americana*, his studies of nut weevils and *Sphenophorus*, and expressed the Society's regret in learning of his death.

The president called for reports of summer work. Among those who spoke were Mr. Mutchler, who exhibited *Calomycterus setarius*, a Japanese beetle which had appeared in great numbers in the garden of Mr. W. M. Faunce, at Colonial Heights, near Yonkers, in July, and had been provisionally identified by Mr. L. L. Buchanan.

Dr. Felt spoke of the effect of the summer's drought as weakening the vitality of many trees, thereby making them more susceptible to the attacks of insects. He also gave some data, derived from this summer's work, on hackberry galls.

Dr. Lutz spoke of his visit to Talulah, La., where he met Dr. Folsom and Mr. Glick and obtained material for a cotton boll weevil group. With a series of photographs he showed some of the activities then in progress, in-

cluding dusting the cotton fields by aeroplane, estimating the abundance of the weevils as a clue to the size of the cotton crop, and collecting by traps attached to aeroplanes the insects carried by air currents at various elevations up to 10,000 feet. Balloons were also used in connection with studies of distribution of cotton moth.

Dr. Felt said that a feature of great economic importance deduced from finding the pink boll worm moth at elevations up to 3000 feet was the apparent futility of zoning restrictions.

Miss Dobroschky spoke briefly of her collection of leaf hoppers in Virginia and West Virginia.

Mr. Angell mentioned some of the insects caught and seen during the summer, *Cicindela 12-punctata*, *Necrophorus vespilloides*, etc.

Mr. Chapin spoke of the genus *Colias*, albino *philodice* plentiful, and *eurytheme* rare; other observers, however, had seen numbers of the latter.

Mr. Bromley spoke of a microlepidopteron apparently injurious to Norway Maple by attacking the tissue at the base of the leaf petiole; also of the Mexican bean beetle in Connecticut, and several species of *Cuterebra* each mimicking some hymenopterous insect. A further subject of study at Stamford had been the cause of spotted leaves on hickory, often making the whole tree yellow and brown, which proved to be a small aphid, *Mesocallus*.

Mr. Frank Johnson spoke briefly of two months he had spent in South America, exhibiting a number of photographs and promising to exhibit some of the more interesting butterflies later.

Mr. Barber had spent the month of July at Ithaca studying the Heide-mann collection of Hemiptera, and visiting McLean Bogs with Dr. Forbes and other localities with Dr. Crosby. Later he had collected in Fairfax County, Virginia, and at Hudson, N. Y., where in spite of drought he had been successful by closely examining grass clumps and mullein which by conserving moisture and providing shelter make natural habitats for insects.

Mr. Nicolay described the Chesapeake Beach locality for *Cicindela puritana* which he had visited with Mr. Herbert Barber and the latter's experiences in bathing there. He had visited Nova Scotia with Mrs. Nicolay, where both made collections. Mrs. Nicolay, being invited to speak by the President, said she had commenced a collection of Carabidæ of the world and had so far eighteen specimens.

Mr. Huntington had made a trip through the Lesser Antilles and Trinidad. In the latter place in about three weeks about ninety specimens of Hesperidæ were caught which will be shown at a later meeting.

Mr. Lemmer had spent every week-end since March at Lakehurst, N. J. Many moths had been caught by baiting, including *lemmeri*, and more at light. *Catocala* ceased to appear about mid-July. An example of the destructive work of the Mexican bean beetle at Glendola, N. J., was shown.

Mr. Leng recorded *Ceutorhynchus marginatus* as plentiful on dandelion on Staten Island.

Mr. Davis exhibited two recent publications on Cicadidæ—Insect Singers by Myers, giving a comprehensive account of the family, and studies on the biology of Kansas cicadas by Dr. R. H. Beamer. In the latter, evidence of the length of nymphal life is adduced for several species.

Mr. Bromley exhibited a collection of Diptera made by Mr. Angell, giving an account of several large robber flies with instances of the great size of their prey, including even katydids.

Mr. Mutchler referred to the popular interest in the praying mantis, in reference to which at least a hundred calls had been made at the American Museum.

Mr. Leng added that as many as six specimens a day had been brought to the museum on Staten Island, where *Paratenodera sinensis* was introduced by Mr. Davis twenty-five years ago.

Among other speakers during the evening were Messrs. Clark, Curran, Hall, Mann, Goodall, Ruckes and Wilson.

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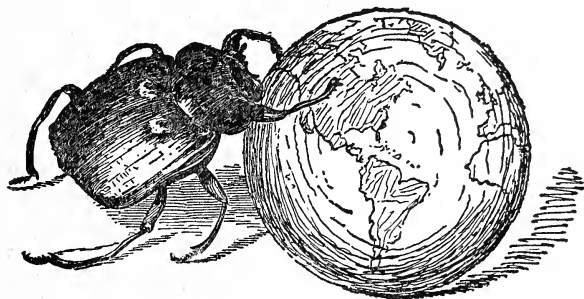
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OF THE
NEW YORK
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Devoted to Entomology in General



JUNE, 1930

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VOL. XXXVIII

JUNE, 1930

No. 2

REARING THE YOUNG OF THE VIVIPAROUS COCKROACH, *PANCHLORA CUBENSIS*

BY WILLIAM T. DAVIS

STATEN ISLAND, N. Y.

In May, 1929, a *Panchlora cubensis* Saussure, was found in a grocery store in Tompkinsville, Staten Island, N. Y., and presented to the writer. The roach was placed in a jar and fed on various fruits, which, as the summer progressed, got mouldy so soon that the food supply was changed almost daily.

In the middle of July it was observed that a number of young cockroaches, about twenty in all, had suddenly appeared, and that the portion of a peach that was in the jar was so soft that they had become immeshed in its substance, and that most of them were dead. They had evidently been born alive, for, as has been stated, the food was changed so often that there was no opportunity for an oötheca to have remained in the jar over two days. If it had been carried about by the female, as in some species of cockroaches, it would have been observed.

Four living young were found and placed in a separate jar with banana peel, a dryer food than the peach, and they did well until the 26th of September when two of them died. Meanwhile the mother *cubensis* had died in late August, after being in captivity about three months.

The remaining two nymphs continued in apparent good health, and on January 22 one was found to have transformed into a green adult male. At that date the remaining nymph was 14

millimeters in length. On January 25 the male was taken to the Staten Island Museum and shown to Mr. Charles W. Leng. We were to exhibit it at the meeting of the Staten Island Nature Club, but by evening it had escaped and could not be found.

On the morning of March 5 the remaining nymph was found to have just transformed into male number two, with the old and brown skin, still soft and limp, lying close by. This living specimen together with the nymphal skin, the two deceased young of September, 1929, and the mother *Panchlora*, were shown at the March 18, 1930, meeting of the New York Entomological Society.

It will be noted that it took the first male cockroach a little over six months to mature, while the second one, under as nearly as possible the same conditions, required nearly eight months. At first the four nymphs kept close together among the folds of the banana peel and were very sociable, and after September 26, when two of them died, the surviving nymphs continued to keep near each other until the first male matured, when, for the three days that he was under observation before his escape, it was noted that he was no longer as sociable, and tended to keep more by himself.

The first statement of the fact that *Panchlora* is viviparous or ovoviparous appears to be found in Dr. C. V. Riley's accounts in *Insect Life*, vol. iii, pages 443-444, 1891, and vol. iv, pages 119-120, 1891, based on observations of Dr. Carl F. Gissler and Gustave Guttenberg, as well as the subsequent examination and dissection of some of the material received from them. In these instances, however, the young were not brought to maturity as in the present case, though there was no doubt of the accuracy of the observations made by Dr. Gissler and Mr. Guttenberg about the young being born alive.

In "Further Notes on *Panchlora*," on page 119 of *Insect Life*, is the statement made by Mr. Guttenberg that the "green cockroach which, while being examined by one of his scholars, had given birth to about thirty living young, besides some individuals still in their 'pupa cases' [egg sacs] and a cluster of about twelve 'pupæ' [eggs] arranged side by side."

This statement can be further verified by the writer, who received on December 19, 1929, from Mr. Carol Stryker, a dead female *Panchlora* that had been put into a box when alive and brought to the Staten Island Museum. In the same box there were found three broken parts of what had possibly been a single mass of eggs, in all about forty-five in number, that upon examination appear to have come from the *Panchlora*. As so often happens among insects, when about to die, she had extruded the eggs.

Dr. Riley identified the species examined by him as *Panchlora viridis*, but Mr. Morgan Hebard states in "The Blattidæ of North America" that no individuals of *viridis*, a South American species, have appeared in collections of material adventive in the United States. In the experience of the writer with adventive material of *Panchlora cubensis*, the females are far more numerous than the males, in fact as yet we have secured no males from grocery and fruit stores.

In addition to *Panchlora cubensis* it is evident that cockroaches of other species are viviparous. In his *Jungle Days*, page 34, William Beebe mentions "a giant wood roach all browns and greys, with marbled wings, strange as to pigment and size. . . . The insect had flown through the rain and into the window, but a glance showed that it was in dire extremity, being in the grasp of a two-inch etenid spider." In a short time while still in the grasp of the spider the cockroach gave birth to about "fifty active roachlets." "They had burst from their mother fully equipped and ready for life. . . . Tiny, green, transparent, fleet, they raced back and forth over the spider. He grasped in vain at their diminutive forms, at the same time still clutching the dying flavorless shred of a mother roach."

In the *Cambridge Natural History*, vol. v, page 229, Dr. Sharp cites Dr. Riley's articles in *Insect Life*, 1891, and continues: "It is well known that some Blattidæ are viviparous. In the case of one such species, *Panchlora viridis*, it appears probable that the egg-capsule is either wanting, or is present in only a very imperfect form." With the exception of Dr. Sharp's statement that some cockroaches are born alive, the standard works on entomology that we have consulted do not mention the fact, and

refer only to the presence of the egg-case or oötheca. Dr. Packard in his *Text-Book of Entomology*, 1909, states that: "The viviparous species are confined to certain May-flies, the Aphidæ, Diptera (Sarcophaga, Tachinidæ, Œstridæ, and Pupipara), and to certain Coleoptera (Stylopidæ and some Staphylinidæ)."

It may be added as a further note that the male, which matured March 5, is still living and doing well on June 8, 1930.

NEW MEMBRACIDÆ, X

BY FREDERIC W. GODING

CENTROTINÆ

*Centrotini***Paraxiphopæus** new genus.

Head triangular, base arcuate, ocelli equidistant even with upper margins of eyes, clypeus narrow, apex acute extended below tips of the sinuate genæ; surface finely punctate with a short median carina from base to middle of vertex; strongly recurved below eyes. Pronotum roughly punctured, vertically elevated above the head; humerals not prominent; supra-humerals very long, rather broad, laterally compressed, margins serrately carinate, directed from nearly contiguous bases upward apical half curved outward and backward, summits somewhat dilated and foliaceous, briefly acute; posterior process rises obliquely from slightly in front of apical margin of the pronotum, then forms an obtuse angle with a tooth in front, cylindrical from base to end of apical third, then laterally compressed, broad with a carina each side near lower margin, apical third nearly perpendicularly decurved, apex briefly acute even with tips of tegmina, upper and lower margins spinose. Tegmina four times longer than broad, narrow, with two discoidal and five apical cells, apical margin obliquely truncate, apical angle acute; clavus with two veins, exterior vein almost reaching apical margin, slightly narrowed from base, apex obtuse. Wings with three apical cells. Sides of chest and trochanters unarmed. Scutellum longer than broad, narrow, punctate, apex narrow, bidentate. Legs simple. Type, *Paraxiphopæus arebiensis* new species.

It differs from *Xiphopæus* Stål. in the wings which have three apical cells.

Paraxiphopæus arebiensis new species.

Black, strongly coarsely punctured, median carina perecurrent; supra-humerals almost touching at bases, surfaces not carinate, carina on hind margin extended to hind margin of pronotum each side. Tegmina sub-opaque yellowish-brown, the clavus and long central stripe clear hyaline. Sides of chest tomentose. Abdomen piceous, margins of segments paler; legs entirely yellow. Type, ♀. Long. cum teg. 9; inter sum. corn. 10; lat. inter hum. 2 mm. From Arebi, NW Congo, Africa. It differs from the other species of the genus in the position of the ocelli, the longer tegmina, etc. (Collection F. W. G.)

Spalirises humilis new species.

Suprahumeralis rather long and slender, directed obliquely upward and forward, prismatic, tips acute slightly recurved; base of posterior process

weakly but distinctly elevated in an obtuse angle, near and touching apex of scutellum, then sinuate following margins of tegmina passing their inner angle. Tegmina dark vinaceous, base opaque. Ocelli equidistant. Long. 7.5-8 mm. Type in Collection Jacobi. This is Fig. A, b-c, on page 35, in Jacobi, Wiss. Erg. Deutsch. Cent.-Afrie. Exped. of 1907-8. (1912.) From Ruwenzori, German Central Africa. It differs from the other described species in the long oblique forward inclined suprahumeral, the less elevated base of the posterior process, and position of the ocelli.

Planecornua new genus.

Head broader than long, base arched, ocelli equidistant or slightly nearer the eyes and base, margins or genæ straight, clypeus extended below apical margin, apex acute. Pronotum coarsely punctate, metopidium much higher than broad, humerals prominent; suprahumeral moderate, transverse, acuminate, tips recurved, disk robustly elevated then angulate and extended posteriorly in a rather slender acuminate process distant from the body, weakly sinuate towards the acute apex which reaches the apex of the fifth apical cell of the corium. Tegmina nearly three times longer than broad with two contiguous discoidal and five apical cells, limbus broad; apex of clavus acute. Wings with three apical cells. Legs simple. Type, *Centrotus infractus* Jacobi. (♂, ♀.)

It differs from *Centrotus* in the strongly elevated disk of the pronotum and the lower margin of the posterior process not lobed, from *Anchon* in the flat horizontal acuminate suprahumeral, and from *Platybelus* in the angulate posterior process.

Uroziophini

Awania vicina new species.

Entirely dull black. Head large, long as broad, finely punctate, weakly pubescent, a median carina from base to the base of clypeus, ocelli even with the center of and nearer to the eyes with a prominent tubercle near base above each, eyes large, globular, protruding, piecous, apical margin of frons rounded, deeply emarginate to form two semicircular foliaceous plates, clypeus large, triangular, rugose, almost entirely below and behind the overlapping apical margin of the frons, apex bluntly pointed. Pronotum convexly gibbous, unarmed, strongly and roughly punctured, slightly pubescent, basal margin projecting prominently forward and smoothly carinate, a smooth spot behind each eye; humerals prominent, rounded; posterior process lightly undulate, very slender from extreme base, tri-carinate, lightly arched above scutellum then impinging upon the tegmina, the median carina acutely elevated but weak on pronotal disk, apex lengthily acute to the apex of the fifth apical cell of corium. Scutellum entirely visible, black, punctate, apex emarginate. Tegmina shining vinaceous hyaline, bases and veins pale ferruginous and punctate; two and a half times longer than broad, apical margin obliquely convex, apical angle acute; two unequal contiguous discoidal and five apical cells; clavus with two

veins, the exterior vein extended to the blunt apical margin. Wings with four apical cells. Body and legs concolorous. Type, ♀, long. 7; lat. 2.5 mm. From Gombari, French Congo, W. Africa.

It differs from *typica* Distant in the position of the ocelli, the projecting basal margin of the pronotum, much longer and narrow posterior process which is nearer to the scutellum and impinges on the tegmina, and color of the middle legs. (Collection F. W. G.)

Leptocentrini

Euxiphopæus new genus.

Head broader than long, punctate, base arched, eyes not large, ocelli slightly nearer to and above the center of eyes, margins of genæ slightly convex, clypeus broad as long, apex acute. Pronotum punctate, front elevated nearly vertical, suprahumeral medium, transverse, gradually acuminate, bases robust, tips decurved, sometimes covered with tubercles; posterior process robustly elevated for a distance from base then abruptly angulate and directed posteriorly, straight, gradually slender and acuminate, smooth or serrate on lower margin, long as or longer than the abdomen. Tegmina sordid hyaline, nearly three times longer than broad, with two contiguous discoidal and five apical cells, apical area variously spotted with brown, tips subacute. Wings with four apical cells. Legs simple. Type, *Xiphopæus geniculatus* Stål. The species closely resembles those of the genus *Planecornua* Goding, but the wings have four apical cells while those of that genus have three. *Xiphopæus hirculus* Jacobi belongs here.

MEMBRACINÆ

Bolbonotini

Leioscyta humeralis new species.

Head black, lightly punctulate, longer than broad, base weakly arched, ocelli nearer to and even with upper margins of the eyes, a slight tubercle above each near base; the lateral margins are emarginate at middle, clypeus large, long as broad, apex acute. Pronotum brownish-piceous, a strong median carina and three lateral carinæ each side short and weak; humerals prominent, red; dorsum lightly sinuate posteriorly, long as abdomen, a short oblique subapical carina each side. Tegmina black with several yellow dots, the exterior half of apical limbus white. Body piceous, legs black, front and middle tibiæ well dilated, hind tibiæ spined, tarsi yellow. Type, ♀, long. 4; lat. 2 mm; one male and two female paratypes, the male slightly smaller. All are from São Paulo, Brazil. The type and one paratype are in the Museu Paulista, São Paulo, and two paratypes in the collection of F. W. G. (Collector, Jose Pinto Fonseca.) It is near *brunnea* Funkhouser, but differs in the broad tibiæ, color, etc.

*Xiphistesini***Xiphidia** new genus.

Margins of the head foliaceous, ocelli equidistant slightly above center of the eyes. Pronotum tumid, unarmed, coarsely punctate, basal margin produced forward, front convex, a small tubercle or short carina above each humeral, median carina percurrent, humerals strong, blunt; posterior process straight, broad at base covering the scutellum, narrowed to the blunt apex which is shorter than tegmina. Tegmina hyaline, broad, with three discoidal and five apical cells, a cross-vein between the two ulnar veins in front of middle, the veins nodulate. Wings with four apical cells. Sides of the chest with a short tooth. Tibiæ dilated. Type, *Gongroneura carinata* Funkhouser.

Allied to *Xiphistes* from which it differs in the absence of suprahumeral. *Xiphistes inermis* Jacobi belongs to this genus.

ON ATÆNIUS STRIGATUS SAY AND ALLIED SPECIES (COLEOPTERA)

BY H. C. FALL

TYNGSBORO, MASSACHUSETTS

The satisfactory identification of Say's *Atænius strigatus* and its separation from the allied *cognatus* Lec. and the hitherto supposedly allied *stercorator* Fab. by means of Horn's Monograph (Trans. Am. Ent. Soc. 1887) has always proved to the writer a puzzling problem. If one is content to simply follow the tabular characters it is usually possible to assign what one has in hand to one or another of the above names, but a critical inspection of the resulting aggregates is disconcerting.

In attacking the problem in my own collection it has become evident that one basic source of misapprehension lies in Horn's characterization of *strigatus* under caption "16" of his key, where he says—"Clypeus finely punctured without traces of rugae." Horn justifies this statement by the following quotation from Say's description—"Clypeus with very minute punctures and larger ones at the base," and then remarks that had there been any clypeal rugae Say would have mentioned them. The inference is a fair one and Say may really have drawn his description from specimens without perceptible clypeal rugae, for there are such examples although they seem to be comparatively rare. In the vast majority of individuals these transverse wrinkles are more or less evident, and a good series of specimens, apparently otherwise specifically identical, will show a complete gradation in this respect between the extremes.

In this connection it should not fail to be noted that Say expressly states that his insect is the "*Scarabæus strigatus* Knoch of the Melsheimer Catalog." It is impossible to believe that he was not appreciative of the significance of the specific name which he accepted, and which could hardly have been suggested by anything else than this same clypeal strigosity. Furthermore Say says that the species is rather common, occurring in Penn-

sylvania and as far west as the Rocky Mountains. So far as I know there are only two species of this group of *Atænius* occurring at all commonly in the Northeastern States, in one of which the clypeal rugæ are in my experience always present though sometimes very faint, and in the other usually evident though occasionally they so nearly disappear as to easily escape observation. One of these two closely allied forms, which I believe are specifically distinct, must be Say's *strigatus*, but since the clypeal rugosity exhibits practically the same range of variation in each of them, the character given by Horn in caption "16" is not distinctive.

A second cause of confusion is the presence in our collections of several as yet undifferentiated but distinct species including one of the two forms just mentioned. Just how many of these undescribed species there are within our faunal limits would require a protracted investigation with very extensive material to determine, a work which I am unable at this time to undertake. I give below, however, as a preliminary study the results of my investigation of the material accessible to me in the small group of species allied to *strigatus* (*inquietus* to *californicus* inclusive of Horn's Monograph) which is admittedly the most difficult in the genus taxinomically speaking.

Types of the species described as new are in the writer's collection.

The group characters of the species here treated, and a table to assist in their separation follow.

Clypeus feebly emarginate, the angles each side broadly rounded; middle and hind tibiæ with accessory spinule; base of thorax broadly arcuate; elytra not pubescent, the discal interspaces at least finely sparsely punctate; hind femora nearly smooth.

A₁. Accessory spinule of middle and hind tibiæ closely adjacent to the shorter spur without intervening spinule of the terminal fringe.

Ventral segments finely sparsely punctate almost throughout, the punctures at the extreme sides only slightly coarser.....*erratus*

Ventral segments coarsely punctate from side to side.....*inquisitus*

A₂. Accessory tibial spinule more removed from the spurs, one of the spinules of the terminal fringe intervening.

B₁. Ventral segments coarsely punctate from side to side; elytral intervals with much coarser punctures at sides and apex than at middle of disk.....*floridanus*

B₂. Ventral segments evidently much more finely punctate or nearly smooth medially.

C₁. Posterior femur with distinct impressed marginal line or groove extending from knee $\frac{2}{3}$ or more of the distance to the trochanter.

D₁. Elytra relatively short and convex, $\frac{1}{3}$ longer than wide, sides distinctly arcuate (suboval), sides of thorax straight and parallel, size small (3.5-3.9 mm.).....*brevis*

D₂. Elytra more oblong and elongate, $\frac{1}{2}$ or more longer than wide, sides of thorax broadly arcuate.

E₁. Mesosternum with a rather long and distinct though obtuse shining carina between the coxae.

Coarse punctures of prothorax nearly or quite wanting antero-medially, the fine punctures unusually dense in this area.....*salutator*

Coarse punctures of prothorax generally distributed, becoming a little larger and closer laterally*ludovicianus*

E₂. Mesosternum scarcely or indistinctly carinate, or at most with only a short incipient carina.

F₁. Coarse punctures of prothorax generally distributed, usually conspicuously numerous or even dense laterally, thorax often feebly narrowed behind, metasternum of male (except in *anticus*) with interspersed larger punctures bearing very short setæ, in addition to the very fine apparently nonsetigerous punctures which alone are present in the female.

Size larger, usually about 4.5 mm., interstitial punctures of elytra very fine, ædagus of male curved downward at apex when viewed in profile.....*strigatus*

Size smaller (length scarcely 3.5 mm. in the unique type), form narrower, interstitial punctures of elytra stronger and more evident, ædagus of male nearly straight in profile, the apex not appreciably deflexed*rudellus*

F₂. Coarse punctures of prothorax generally distributed but everywhere rather sparse, not or but little closer laterally; thorax not narrowed behind; ædagus of male arcuate in profile, curved downward at apex, impressed above toward the base.....*consors*

- F₃. Coarse punctures of thorax almost or quite lacking in an antero-median area of considerable size; metasternum similarly minutely punctate in both sexes; ædagus of male dilated apically, the tip not curved downward; size rather small (3.6-4 mm.) *anticus*
- C₂. Posterior femur without or with only a short feeble marginal line near the knee.
 Ventral segments evidently punctate at middle; size larger as a rule. (Texas; New Mexico.) *cognatus*
 Ventral segments nearly smooth at middle, the coarser punctures of the prothorax relatively larger; size a little smaller *californicus*

Atænius erratus new species.

Elongate oblong, black, shining, the elytra very finely but perceptibly alutaceous in the female, scarcely detectably so in the male.

Head finely sparsely punctulate with slightly coarser punctures at base, and with fine transverse rugulosity in front which varies from fairly distinct to almost wanting; clypeus at middle broadly sinuate with rounded angles.

Prothorax rather strongly transverse, shorter than usual as compared with the length of the elytra, sides subparallel and broadly arcuate; surface strongly shining with the usual dual punctuation, the minute punctures very sparse, the coarser punctures numerous and rather evenly distributed, being only a little coarser laterally and slightly finer and sparser antero-medially.

Elytra elongate, parallel, slightly wider than the thorax; striæ fine, scarcely visibly punctulate at bottom, the punctures along the inner margins of the intervals unusually fine; intervals feebly convex and minutely punctate.

Mesosternum not distinctly carinate between the coxæ; ventral segments finely sparsely punctured almost throughout, the punctures at sides not coarser except slightly so at the extreme margins; marginal line of hind femur extending more than half the distance to the trochanter; accessory spinule of the four posterior tibiæ closely adjacent to the spurs without intervening spinule of the terminal fringe.

Length 5-5.25 mm.; width 2.1-2.2 mm.

The type is one of three examples from Enterprise, Florida, submitted by Mr. Liebeck, who writes me that they are like the specimen referred to by Horn following his description of *strigatus* as presumably a male of that species. In this specimen of Horn's, which is from Georgia, the spur of the anterior tibia is as mentioned by him rather strongly incurved at apex, un-

doubtedly a male character. None of the Enterprise specimens show this, and they are by this token all females.

The distinctive characters of this species are the relatively short thorax and long elytra; the unusually fine crenations of the inner margins of the elytral intervals, the fine and nearly uniform punctuation of the ventral segments, and the close propinquity of the accessory tibial spinule to the shorter of the terminal spurs. I have observed this last character only in *inquisitus* among the other species of this group, the accessory spinule in all others being a little removed from the spur with one of the spinules of the terminal fringe intervening.

***Atænius inquisitus* Horn.**

Superficially this species is very similar to most of the others of the *strigatus* group, but aside from having the ventral segments coarsely punctate from side to side, it possesses three other characters of diagnostic value, none of which were recognized as such by Horn. In all the species of the *strigatus* series there is a group of more or less confluent coarse punctures forming a rugose or eroded area of variable extent along the side margins of the metasternum. Within this lateral rugose area the sides of the metasternum bear only a few fine scattered punctures in all the related species, but in *inquisitus* there is an irregular series of coarse punctures extending inward to the central flattened area. The accessory spinule of the middle and hind tibiæ is appreciably more strongly developed than in any other species known to me, and its close contiguity to the tibial spurs is paralleled only in *erratus* as is indicated in the tabular key.

Horn's specimens of *inquisitus* were from Southwestern Texas. Those in my series are from Brownsville and Alpine, Texas.

***Atænius floridanus* Brown.**

Stout, oblong, somewhat strongly convex; black, shining, the elytra with traces of very fine alutaceous sculpture toward sides and apex.

Head distinctly transversely rugulose anteriorly, finely punctate at middle, with a rather wider and distinctly denser belt of coarse punctures at base than in the other species of the group; clypeus sinuato-emarginate with rounded angles.

Prothorax moderately transverse, sides parallel and feebly arcuate, a little more so anteriorly; coarse punctures quite dense laterally, sparser and a little finer medially.

Elytra at base perceptibly narrower than the thorax, at middle very slightly wider than the latter; striae deep, interspaces flatly convex on the disk, becoming distinctly convex at sides and strongly so at apex; interspaces very finely punctulate as usual at middle of disk, the punctures becoming very much coarser at sides and apex, where on the declivity they form a single series occupying almost the entire width of the summit of the interspace; striae evidently punctate, inner margins of intervals strongly crenately punctate.

Posterior face of profemur coarsely numerous punctate; mesosternum obtusely carinate between the coxae; metafemoral marginal line coarse and deep, extending fully two-thirds the distance from knee to trochanter; ventral segments very coarsely and closely punctate from side to side, only a little less coarsely so medially.

Length, 4.5–5 mm.; width, 2.1–2.2 mm.

Florida. This species has been recently described (Can. Ent., Jan., 1930, p. 3) by Mr. W. J. Brown from a single specimen without more precise indication of locality. I have myself seen four examples, three in Mr. Liebeck's collection (Biscayne and Levy Co., Florida), the fourth being the specimen in the LeConte collection referred to by Horn as the only example of *stercorator* known to him from our territory; it bears the label "Sand Point, Fla.," and was collected by Hubbard or Schwarz.

The stout form, coarse punctuation of the elytral intervals at sides and apex, and the very coarse ventral punctuation characterize this species. It is very closely allied to and probably only a geographical variant or race of the Mexican *strigicauda* Bates, a specimen of which from the Biologia material is before me. In the latter the head is as coarsely punctured at sides as at base, the elytral interspaces are perceptibly more convex on the disk, and their inner margins are more coarsely crenate.

Atænius brevis new species.

Rather short oblong-oval, convex, black, shining; integuments polished, the elytra faintly alutaceous only under strong amplification; legs dark rufous.

Head finely but perceptibly wrinkled in front, finely punctate medially, occiput with coarse punctures which are more numerous toward the sides; clypeal margin arcuato-emarginate with rounded angles.

Prothorax two-fifths wider than long, sides viewed from above very nearly straight and parallel; coarser punctures generally distributed, rather densely aggregated laterally, sparser and somewhat finer medially, especially in front.

Elytra one-third longer than wide, sides more evidently arcuate than usual, intervals a little convex with minute scattered punctures.

Mesosternum with a moderately distinct but obtuse intercoxal carina; ventral segments strongly punctured at sides, finely and very sparsely so at middle; posterior (lower) face of profemur strongly punctate; marginal line of posterior femur long, extending from knee three-fifths to trochanter.

Length, 3.5-3.9 mm.; width, 1.6-1.75 mm.

Described from two examples of undetermined sex labelled simply Pennsylvania and collected by Henry Ulke many years ago. The specimens were probably taken in the Blue Ridge Mts., where Ulke had a summer home or camp, in the vicinity of which he did a good deal of collecting. Mr. Liebick writes me that he has seen twelve or fifteen specimens of this species, all collected and distributed by Ulke. There are specimens in the Liebeck and Horn Collections, and the Ulke collection should contain a good series.

***Atenius saluator* new species.**

Of rather large size, oblong, moderately convex, black, shining, integuments not perceptibly alutaceous.

Head distinctly wrinkled in front, finely punctate medially, with sparse somewhat coarser punctures at base; clypeal margin broadly emarginate with rounded angles.

Prothorax moderately transverse, sides parallel and feebly arcuate, slightly narrowed in front in the type; coarser punctures a little larger and more numerous but not dense at sides, somewhat finer on the disk, and almost wholly lacking antero-medially, the fine punctures in this area more numerous and evenly disposed than usual.

Elytra at base as wide as the thorax, sides nearly straight and parallel in about basal three-fifths; striæ deep; intervals nearly flat at middle of disk, becoming gradually more convex toward the sides and apex, finely sparsely punctate and with a row of punctures crenating their inner margins.

Mesosternum with a rather long polished intercoxal carina; ventral segments very finely sparsely punctate in middle third, moderately coarsely so at sides; marginal line of hind femur well impressed and extending from the knee a little more than half way to the trochanter.

Length (type), 5.6 mm.; width, 2.35 mm.

Described from a single example, apparently a female, taken by the writer at Pensacola, Florida, July 8, 1893.

The type agrees very closely with the specimens standing as *stercorator* Fab. in the Horn collection. As I am informed by Mr. Liebeck there are three of these and all without locality labels. There however can be no doubt that they are the Buenos Ayres specimens which Horn says were sent to him as *stercorator* by Candeze, and it is from them that Horn drew his description of this species. As will be explained further on it now turns out that these Buenos Ayres specimens from Candeze are not the true *stercorator* nor have I been able to ascertain whether they actually have a name or not. I have therefore for the sake of completeness thought best to describe the Pensacola species and take the risk of creating a synonym.

***Atænius ludovicianus* new species.**

Of rather large size, moderately robust, oblong, shining, black, legs brownish piceous; elytra very finely alutaceous, the thorax not visibly so.

Head transversely wrinkled anteriorly, finely punctate at middle, more coarsely so at base; clypeus broadly arcuately emarginate with rounded angles.

Prothorax moderately transverse, sides feebly arcuate, and either parallel or slightly convergent behind; coarser punctures of surface everywhere numerous, but a little larger and denser laterally.

Elytra slightly wider at base than the thorax, sides parallel to behind the middle, intervals nearly flat on the disk, interstitial punctures fine and sparse.

Mesosternum with a moderately long intercoxal carina; ventral segments coarsely punctate at sides, very finely and sparsely so medially; marginal line of hind femur rather fine, extending from the knee two-fifths the distance to the trochanter.

Length, 4.3–4.8 mm.; width, 1.9–2.2 mm.

Described from three examples (2 ♂, 1 ♀) collected at Winnfield, Louisiana, by Mr. G. R. Pilate. In the male type the thorax is perceptibly narrowed behind; in the other male there is no posterior narrowing while in the female the form is intermediate between these two. In the male type the metasternum is very finely punctate in front, with distinctly coarser punctures posteriorly; in the female the metasternum is finely punctulate throughout. In both males the inner spur of the anterior tibiæ is distinctly more strongly incurved at tip than in the female.

Atænius strigatus Say.

This species, the first of the genus to be made known from our fauna, was described by Say (as an *Aphodius*) in 1823. He observes that his insect is the *Scarabaus strigatus* Knoch of the Melsheimer Catalog and that it is rather common in Pennsylvania. Since Melsheimer's material was collected for the most part in Pennsylvania it is fair to consider this the type region of the species. As Say did not mention any clypeal rugæ in his description Horn assumed this to be characteristic of the species, and the series in his cabinet was selected on this basis. It happens, however, as I have already pointed out, that there are two species, hitherto confused, occurring more or less commonly in this region, in both of which the clypeal sculpture varies much, occasional examples being found in each with the clypeal rugæ virtually wanting; some other means must therefore be found for their distinction.

In my search for such a means of distinction I have discovered in the punctuation of the rear or lower face of the anterior femur a character which seems to me most nearly to meet this requirement. In one of the two species the femur shows numerous coarse punctures, which in the more extreme forms may become in part rugosely subconfluent; in the other species the profemur is very finely and remotely punctate with at most only very few interspersed coarser punctures. In both species this punctuation varies somewhat individually, but very rarely sufficiently to cause doubt as to which category the given specimen belongs.

In order to determine to which of these two species the *strigatus* of the Horn collection belongs, Mr. Liebeck has sent me examples found by careful comparison to be identical with the specimen on the name label in the Horn cabinet. This specimen and most of the others in the Horn series are from Georgia and prove to be the species with coarsely punctate profemur. Oddly enough there are no specimens from Pennsylvania or any of the adjoining states in the Horn series.

In the Harris collection, now in the possession of the Boston Society of Natural History, Mr. C. W. Johnson, the curator, writes me there are two examples bearing No. 1043 and entered

in red ink in the Harris Note Book as *Aphodius strigatus* Say, with the additional data Milton (Mass.), Sept. 20, '29, and Cambridge, June 1, '32. The red ink entry signifies that the names thus written were sent by Say after examining the collection which Harris sent him in Nov., 1833. Mr. Johnson has kindly sent me one of these two Mass. specimens for inspection; it is the species with finely punctate femur.

Finally an examination of the Melsheimer collection reveals a series of six "Melsh." specimens of *A. strigatus*, five of which have the profemur coarsely punctate. In the sixth the rear surface of the femur is not visible but the general aspect of the specimen is that of the species with finely punctate profemur. This last observation seems to me most significant of all and goes far toward convincing me that the name *strigatus* properly belongs to the species with coarsely punctate profemur, and it is so applied in this paper.

As thus determined *strigatus* is a species of medium size, ranging as a rule between $4\frac{1}{4}$ and $4\frac{3}{4}$ mm. in length. The clypeal rugæ are usually distinct but quite variable in development and now and again are practically obsolete. The coarser punctures of the pronotum are smaller and sparser medially, especially in front, but become as a rule conspicuously closer or even dense laterally, though occasionally they are not very much so. The prothorax is not infrequently feebly narrowed behind but this character is not a constant one; I have observed it most often in examples from the Middle Western States. The punctuation of the ventral segments is as usual rather coarse at sides becoming finer at middle, but the change is here more gradual and the disparity much less marked than in certain other species, notably *salutator*, *ludovicianus* and *californicus*, which are at once separable from the present species on this character alone. The coarse punctures of the posterior face of the profemur have already been mentioned as of especial service in separating this species from the closely allied *consors*, with which from community of habitat it is most likely to be confused.

Horn alludes to a specimen in his *strigatus* series as probably a male, the anterior tibiæ being somewhat more slender and the terminal spur incurved at tip. The apical curvature of the

tibial spur is undoubtedly a male character, but the example alluded to belongs to an entirely distinct species (the *erratus* of the present paper) and not to *strigatus*, in which I have discovered no appreciable sexual difference in the tibial spur. I have, however, noted a hitherto unobserved sexual character which is well marked in the present species and several others. This pertains to the metasternum, which in the female is very finely and sparsely punctulate, but in the male shows a number of coarser punctures bearing very short setæ, which in well-preserved examples are easily visible in profile.

Strigatus is widely dispersed from New England to Georgia and the Mississippi Valley. I possess or have seen specimens from the following states. New Hampshire; Massachusetts; New York; New Jersey; Pennsylvania; Virginia; Georgia; Kentucky; Indiana; Illinois; Iowa; Kansas; and Arkansas.

***Atænius rudellus* new species.**

Rather small and narrow for the present group, the size and form being nearly as in one of the larger examples of *abditus*. Black, legs dark rufopiceous, surface not very strongly shining because of the close punctuation of the thorax and the fine but evident alutaceous sculpture of the elytra. Clypeal margin with the usual sinus and rounded angles; head with feeble traces of transverse rugæ in front, the punctuation of the usual type but distinctly stronger and denser than in *strigatus*.

Prothorax subequal in width to the base of the elytra, sides broadly arcuate and parallel, coarser punctures very numerous and everywhere present, finer and sparser antero-medially, and coarser and denser laterally as usual.

Elytra oblong, sides parallel to behind the middle, sutural length about two-fifths greater than the width; intervals broadly but perceptibly convex on the disk, becoming quite strongly so at apex; interstitial punctures stronger and more distinct than in allied species; mesosternum with a feeble obtuse carina; hind femur with marginal impressed line extending from knee two-fifths to trochanter.

Length, 3.5 mm.; width, 1.6 mm.

St. Petersburg, Florida. A single male taken by the writer April 2, 1922.

In the unique male type the spur of the anterior tibia is rather abruptly bent inwardly at tip; the metasternum is very finely punctate in front with coarser punctures in posterior half; the œdagus is short and obtusely rounded at the apex, which is not

deflexed as viewed from the side; the accessory tibial spinule is very short.

Atænius consors new species.

Of medium size, oblong oval, moderately convex, black, shining, integuments not distinctly alutaceous under the usual amplification.

Head with fine transverse wrinkles anteriorly which vary from barely perceptible to well defined; vertex finely sparsely punctate, with coarser punctures at base; clypeus with the usual sinuate emargination with rounded angles.

Prothorax moderately transverse, sides parallel and usually broadly arcuate, but becoming nearly straight in some examples; coarser punctures comparatively sparse, much less numerous than in *strigatus*, generally but unevenly dispersed, not much sparser or larger laterally than at middle, except anteriorly, where as usual they are fewer and smaller.

Elytra at base as wide as the thorax, sides parallel and nearly straight in basal half; intervals very feebly convex on the disk; interstitial punctures sparse and minute.

Profemur finely sparsely punctate on its posterior face; marginal line of hind femur deep, extending half way or more from the knee to the trochanter; ventral segments finely sparsely punctate medially, more coarsely so at sides.

Length, 4-4.8 mm (head deflexed); width, 1.8-2 mm. One very large example with head extended measures 5.5×2.35 mm.

The following localities are represented in my collection or are known to me. Massachusetts (Lawrence, Milton, Cambridge); New York (Peekskill); New Jersey; Pennsylvania (Mt. Airy, Moore's, Bucks Co.); District of Columbia; North Carolina (Highlands); Florida (Biscayne, Paradise Key); Tennessee (Madison); Missouri (St. Louis); Arkansas (Hope); Louisiana (Winnfield, New Orleans); Kansas (Lawrence, Argentine); New Mexico (Elba).

The type is a male from Lawrence, Mass., bearing date of 30 Aug., 1920, and collected by Miss Edith W. Mank.

I do not detect any appreciable sexual difference in the spurs of the protibiae, but here as in *strigatus* the males are easily recognized by the presence of the coarser setiferous punctures of the metasternum, the metasternal punctures in the female being very fine and non-setiferous.

As will be seen from a glance at the localities given, this species and *strigatus* range over pretty much the same territory.

As compared with *strigatus*, *consors* is on the average a little larger and more robust; the coarse punctures of the pronotum are very much fewer, though owing to some individual variation the disparity is not equally marked in all specimens; the posterior face of the profemur is much less punctate; the ædagus while of nearly similar form, is so far as examined a little different in outline, notably because of a well-marked depression above near the base, which is nearly or quite wanting in *strigatus*. In *strigatus* the prothorax is not rarely a little narrowed posteriorly, not so in any examples of *consors* thus far examined. The clypeal rugosity shows a nearly similar amount of variation in both species.

***Atænius anticus* new species.**

A little smaller and narrower than *strigatus*, and very markedly so as compared with *consors*. Black, femora piceous, tibiæ and tarsi brownish; integuments strongly shining, not perceptibly alutaceous.

Head in anterior half or more conspicuously transversely wrinkled, vertex finely sparsely punctate, at base with very few punctures which are nearly or quite as fine as those of the vertex; clypeus broadly emarginate with rounded angles.

Prothorax a little less transverse than in *strigatus*, not narrowed behind, sides parallel and broadly feebly arcuate; pronotum with the usual dual punctuation, the coarser punctures nowhere dense and almost or quite wanting in an antero-median area which usually reaches half way to base on the disk and involves the middle half of the apex; in this area the fine punctures are evenly distributed.

Elytra at base subequal in width to the thorax, fully to rather more than one-half longer than wide (about two-fifths longer than wide in *strigatus* and *consors*); intervals nearly flat on the disk, with the usual fine interstitial punctures.

Mesosternum not distinctly carinate; marginal line of hind femur feeble but visible, reaching from the knee about one-third distance to the trochanter; ventral segments more finely punctate at middle.

Length, 3.6–4 mm.; width 1.4–1.75 mm.

I have received a good series of this species from Hope, Arkansas, where it was taken abundantly at light by Miss Louise Knobel. I have seen it also from Hot Springs, Ark., Winnfield, La., Dunedin and Enterprise, Fla., and Tybee Isl., Georgia. The type is a male from the first named locality.

Unlike *strigatus* and *consors* males of this species are not distinguishable by the metasternal punctuation, this being similarly

fine and sparse in both sexes. The form of the male genital organ differs from that in all other species examined in being distinctly dilated apically, the tip not deflexed. Briefly stated the characteristic features of this species are the rather small and narrow form, the head conspicuously wrinkled anteriorly and at base with fine sparse punctures instead of the usual coarser ones, the absence or near absence of coarser punctures in a rather large antero-median pronotal area, metasternal area similarly finely punctate in the sexes, marginal line of hind femur weak, ædagus dilated apically.

Atænius cognatus Lec.

So far as I have yet discovered there is only one obvious external character by which this species may be separated from *consors*, viz.—marginal impressed line of the hind femur very short and feeble or altogether wanting, as given in couplet “18” of Horn’s table. There is contributory evidence of the distinctness of the two species in the fact that in the single male *cognatus* which I have been able to dissect the genital organ is somewhat different from that in *consors*, and that of the dozen examples of *cognatus* seen all are from Texas or Sonora (2 exs. in the LeConte type series), while no specimens of *consors* have as yet been recognized from Texas, although from its occurrence in neighboring states it may fairly be expected to be found there.

Horn’s description of *cognatus* is sufficiently accurate and need not be repeated. The head is distinctly wrinkled in front; the coarser punctures of the pronotum are as in *consors* scattered over the whole surface, and while usually a little closer and coarser laterally, seem not to be densely aggregated at sides as they frequently are in *strigatus*. Horn describes the metasternum as having a few coarse punctures at middle. He was unaware that this is a male character, the female having the same area sparsely very finely punctured. Horn’s statement that this species “occurs from the New England States to the Rocky Mts., Texas and Sonora” is due to a confusion of species.

LeConte’s original series of *cognatus* consists of four specimens said to have been collected by Haldeman and Webb in Texas and Sonora. Two of the specimens, including the one on

the label are pinned and two are mounted on points, the difference in mounting probably indicating the two sources of supply. The pinned specimens I believe to have been collected by Haldeman in Southern Texas, and the one on the name label must be considered the type. The other pinned specimen has a long metafemoral line and is probably a different species. The two specimens on points are I believe the Sonora ones collected by Webb, and are possibly a third species, but as they agree with the type in the absence of a femoral line they may stand as *cognatus* for the present.

Specimens of this species are known to me from Brownsville, San Antonio and Amarillo, Texas, while others bear simply the label "Tex." An example in my own collection from Roswell, New Mexico, and a similar one in Mr. Liebeck's collection from Organ Mts., N. Mex., lack the femoral line but the ventral punctuation is nearly as coarse at middle as at sides, and they may represent a distinct species.

***Atænius californicus* Horn.**

The tabular characters combined with the locality label should suffice for the separation of this species from all others now known to us. Horn described it from San Bernardino. I have it from along the Colorado River at Yuma and East Bridge and also from Indio in the Colorado Desert.

***Atænius stercorator* Fab.**

Following his line or two of description of this species Fabricius remarks "Habitat in America meridionali." In 1848 Haldeman doubtfully referred one of our insects to Fabricius' species, and for more than eighty years *stercorator* has been accredited to our fauna.

In his Synopsis of the Aphodiini of the United States (Trans. Am. Ent. Soc., 1871) Horn wrote that he had received from Candèze typical examples of *stercorator* from the Pampas of Buenos Ayres, and decided that they were the same as the *strigatus* of Say. In his later paper of 1887 Horn declares his previous decision to have been in error and adds that "Among the numerous specimens of the group which are usually aggre-

gated as *stercorator* in collections, I have seen but one specimen in the cabinet of Dr. LeConte which can be considered a true *stercorator*."

In the meantime (1886) and probably not yet seen by Horn at the time of writing Bates points out in the *Biologia* that the original type of *stercorator* is in the British Museum collection in a good state of preservation, and is a wholly different thing from the *stercorator* of von Harold, which latter Bates proceeds to describe under the name *strigicauda*. Through the kindness of Mr. Arrow I have been privileged to examine an example of *stercorator* from the same locality as Fabricius' type (Rio Janeiro) and said by Mr. Arrow to be in every way identical with the latter, also an example of *strigicauda* from the *Biologia* material. I can now positively assert that we have nothing in our fauna at all like the true *stercorator*, and furthermore that the specimen in the LeConte cabinet so referred by Horn is very close indeed to the specimen of *strigicauda* sent me by Mr. Arrow and is not the same thing as the Buenos Ayres species from Candeze in the Horn collection. As to this latter see my description of *A. saluator* n. sp. on a preceding page. The LeConte specimen above referred to is the same as *A. floridanus* Brown.

The true *stercorator* turns out to be a robust species of dull surface lustre, the head and thorax densely coarsely punctate, the latter without the interspersed fine punctules common to all our species of the *strigatus* group; the elytra alutaceous and not at all shining, striae distinctly punctate, the intervals not appreciably crenate along their inner edges; middle and hind tibiae with a row of obtuse tubercles along the inner edge. Mr. Arrow writes that he believes these tubercles to be a male character and that his *A. tenebrosus* which lacks them is probably only the female of *stercorator*. The four posterior tibiae lack the accessory spinule, which fact excludes *stercorator* from the *strigatus* group.

RECORDS AND DESCRIPTIONS OF NEOTROPICAL
CRANE-FLIES (TIPULIDÆ, DIPTERA), VIII

BY CHARLES P. ALEXANDER

AMHERST, MASS.

The preceding part under this title was published in 1929 (JOURNAL N. Y. ENTOMOLOGICAL SOCIETY, 37:395-407). The majority of the species discussed at this time were included in very large collections of crane-flies that were taken in Mexico, British Honduras and Guatemala by my friend Dr. Alfons M. Dampf, Government Entomologist for Mexico. Other important series were collected by Dr. John Myers and Mr. Fred W. Walker, the types of the latter being included in the Museum of Zoölogy of the University of Michigan. One additional species was collected by Mr. J. J. White and was given to me by Dr. Crampton. I wish to express my sincere appreciation and thanks to the entomologists named. Except where stated to the contrary, the types of the novelties are preserved in my collection.

Genus *Limonia* Meigen***Limonia* (*Geranomyia*) *neopentheres* new species.**

Allied to *L. (G.) pentheres* (Alexander), differing in the small size and details of structure of the male hypopygium.

MALE.—Length (excluding rostrum) about 4.5 mm.; wing 5.5 mm.; rostrum about 3.3 mm.

Rostrum unusually long and slender, dark brown. Antennæ black throughout; flagellar segments short-oval, with short, inconspicuous verticils. Head gray, the vertex with an impressed median furrow.

Mesonotum brown, the humeral region extensively light yellow; scutal lobes conspicuously variegated with brownish black; scutellum testaceous; postnotal mediotergite dark brown medially, paler laterally and on cephalic portion. Pleura testaceous yellow. Halteres pale, the knobs dark brown. Legs with the coxæ and trochanters pale yellow; femora brownish yellow, the tibiæ and tarsi somewhat darker. Wings with a faint dusky tinge, the oval stigma brown; veins brownish black. Venation: Sc_1 ending about opposite two-fifths the length of Rs , Sc_2 close to its tip; a supernumerary cross-vein in cell Sc ; Rs nearly straight; free tip of Sc_2 some distance basad of R_2 ; $m-cu$ before fork of M .

Abdomen dark brown, the sternites paler; hypopygium chiefly dark. Male hypopygium of the general structure of *pentheres*, differing in the details. Ninth tergite transverse, with a very deep median notch, the lateral lobes relatively broad, not narrowed into slender lobules as in *pentheres*. Ventral dististyle with the spines of the rostral prolongation more strongly curved and unequal in length. Dorsal dististyle shorter and less arcuated.

Habitat.—Mexico.

Holotype, ♂, Córdoba, October 12, 1924 (A. M. Dampf).

***Limonia (Geranomyia) brevispinula*, new species.**

Allied to *L. (G.) canadensis*; thorax almost uniformly greenish testaceous; wings with a faint brown tinge, the oval stigma darker brown; male hypopygium with the spines of the rostral prolongation of the ventral dististyle short and nearly straight.

MALE.—Length (excluding rostrum) about 6 mm.; wing 6.5 mm.; rostrum about 3.6 mm.

Rostrum relatively elongate, brown, paler at base. Antennæ dark brown; flagellar segments oval, the verticals short and inconspicuous. Head infuscated behind, sparsely pruinose, the front and occiput brighter; anterior vertex narrow.

Mesonotum and pleura almost uniformly greenish testaceous. Halteres pale, the knobs weakly infuscated. Legs with the coxæ and trochanters pale; femora pale brown, their bases brighter; tarsi passing into dark brown at tips. Wings with a faint brown tinge, the oval stigma darker brown; veins dark brown. Venation: Sc_1 ending about opposite three-fourths the length of Rs , Sc_2 not far from its tip; Rs nearly straight; $r-m$ reduced in length; $m-cu$ not far from the fork of M .

Abdomen pale brown. Male hypopygium with the caudal margin of the ninth tergite with a broad U-shaped median notch, the lateral lobes broadly rounded. Ventral dististyle large and fleshy, the rostral prolongation relatively small, a little longer than the two spines, the latter unusually short, nearly straight, placed side by side on small basal tubercles. Gonapophyses with the mesal apical lobes long and relatively narrow, the margin microscopically serrate.

Habitat.—Mexico.

Holotype, ♂, Córdoba, November 23, 1924 (A. M. Dampf).

The present species is readily told from *canadensis* (Westwood) and allied forms by the unusually short and unmodified spines of the ventral dististyle.

***Limonia (Geranomyia) viridula*, new species.**

MALE.—Length (excluding rostrum) about 3.6 mm.; wing 4.4 mm.; rostrum about 3.1 mm.

Generally similar and allied to *L. (G.) virescens* (Lw.), differing in the details of structure of the rostrum and male hypopygium.

Rostrum unusually elongate, as shown by the measurements, pale brownish yellow, the outer ends of the labial palpi darker. Antennæ with the basal segment pale, the remainder black; flagellar segments short-oval. Head brownish gray.

Mesothorax entirely light green. Halteres pale green. Legs pale green, the outer tarsal segments darkened. Wings greenish subhyaline, the stigma pale, scarcely evident; veins greenish brown. Venation: Sc_1 ending about opposite one-third the length of Rs , Sc_2 near its tip; $r-m$ shortened; $m-cu$ at fork of M .

Abdomen greenish yellow, including the hypopygium. Male hypopygium with the tergite transverse, the caudal margin broadly emarginate. Ventral dististyle large and fleshy, the rostral prolongation relatively small, shorter than the spines, the latter unequal, divergent; outer spine from a small basal tubercle, shorter and more slender than the inner which arises from a larger stout tubercle and is strongly curved on basal half. Gonapophyses with the mesal apical lobe pale, slender and elongate, gently curved to the acute tip. -

Habitat.—Mexico (Yucatan).

Holotype, ♂, Payo Obispo, Quintana Roo, September 16, 1925 (A. M. Dampf); M. F. No. 682.

***Limonia (Geranomyyia) viridella*, new species.**

MALE.—Length (excluding rostrum) about 4 mm.; wing 5 mm.; rostrum about 2.2 mm.

Generally similar and allied to *L. (G.) virescens* (Lw.), differing in the details of coloration and structure of the male hypopygium.

Rostrum relatively short, as compared with *viridula*, new species, the base paler than the dark brown labial palpi. Antennæ black throughout; flagellar segments oval. Head brownish gray.

Mesonotum yellowish green, presumably entirely pale green in living individuals. Halteres dark green, the knobs brownish black. Legs with the coxæ and trochanters yellowish green; remainder of legs dark green; outer tarsal segments still darker. Wings with a faint dusky tinge, the oval stigma dark green; veins dark brown. Venation: Sc relatively long, Sc_1 ending about opposite two-fifths Rs , Sc_2 close to its tip; a supernumerary crossvein in cell Sc ; free tip of Sc_2 a short distance before R_2 ; $r-m$ elongate; $m-cu$ close to fork of M , subequal to distal section of Cu_1 .

Abdomen pale greenish yellow. Male hypopygium with the tergite transverse, the caudal margin very gently emarginate, the lateral lobes very low. Ventral dististyle large and fleshy, dusky in color; rostral prolongation small, much shorter than the rostral spines; latter slightly unequal, the outer arising from a larger tubercle, longer and more curved; inner spine more

nearly straight. Gonapophyses with the mesal apical lobe darkened, slender, the margins smooth, gently curved to a subacute tip.

Habitat.—British Honduras.

Holotype, ♂, Yalbac, Cayo District, October 20, 1925 (A. M. Dampf); M. F. No. 738.

Limonia (Geranomysia) subvirescens, new species.

MALE.—Length (excluding rostrum) about 4.5 mm.; wing 5.8 mm.; rostrum about 2.3 mm.

FEMALE.—Length (excluding rostrum) about 5 mm.; wing about 4.5 mm.; rostrum about 3 mm.

Characters generally as in *L. (G.) virescens* (Lw.), differing in the venation and structure of the male hypopygium.

Rostrum of moderate length, in male approximately one-half the length of body, pale at base, the labial palpi darkened outwardly. Basal segment of antennae conspicuously pale green; flagellar segments dark brown. Head greenish.

General coloration of thorax brownish green, probably clear green in life. Legs obscure yellow, the outer tarsal segments darkened. Wings nearly hyaline, the stigma oval, pale brown; veins darker brown, those of the costal region brighter. Venation: *Sc* long (♂), *Sc*₁ ending beyond midlength of the relatively long *Rs*, *Sc*₂ close to its tip; free tip of *Sc*₂ lying far proximad of *R*₂; *r-m* very short to obliterated by approximation of adjoining veins; *m-cu* close to fork of *M*.

Male hypopygium with the tergite transverse, the caudal margin with a broad U-shaped median notch, the rounded lateral lobes conspicuously setiferous. Ventral dististyle large and fleshy, the rostral prolongation short and stout, the two spines about as long as the prolongation and thus comparatively short for this group of species, subequal, placed close together on basal half of prolongation; spines from low basal tubercles, their tips acute. Gonapophyses with the mesal apical lobe elongate, pale, relatively wide, the margin microscopically serrulate.

Habitat.—Cuba.

Holotype, ♂, Trinidad Mts., altitude 1000 feet, March 25, 1925 (J. G. Myers).

Allotopotype, ♀, pinned with type.

It seems very possible that the female I have associated with the type belongs to a distinct species; *Sc* is much shorter and the rostrum conspicuously longer than in the holotype male.

Genus *Teucholabis* Osten Sacken

Teucholabis (Teucholabis) furva, new species.

General coloration obscure yellow, the præscutum with three black stripes; head black, somewhat shiny; pleura yellow, with a broad dark brown longi-

tudinal stripe; halteres uniformly dark brown; wings relatively narrow, with a faint brown suffusion; stigma darker brown.

MALE.—Length about 5 mm.; wing 5.2 mm.

Rostrum relatively long and slender, about as long as the rest of the head, black; palpi black. Antennæ with the first scapal segment dark brown, the remainder black; flagellar segments oval, becoming smaller outwardly, clothed with an erect white pubescence and longer black verticils. Head black, somewhat shiny, the occiput brown.

Pronotum yellow, becoming dark brown laterally. Mesonotal præscutum shiny fulvous-yellow, becoming clearer yellow laterally, with three shiny black stripes that are widely separated from one another; median stripe narrow, almost broken beyond midlength, becoming a little wider at the suture; scutum obscure yellow, each lobe largely covered by a brownish black area; scutellum obscure yellow testaceous; postnotal mediotergite black with an obscure yellow area on either side. Pleura yellow, traversed by a broad dark brown longitudinal stripe that extends from the pronotum, passing above the root of the halteres to the postnotum, the dorsopleural membrane and dorsal portion of the pleurotergite remaining of the ground-color. Halteres uniformly dark brown. Legs with the fore coxæ brown, the other coxæ yellow; trochanters yellowish testaceous; femora obscure yellow, the tips dark brown; tibiæ brownish yellow, the tips narrowly blackened; tarsi black. Wings with a faint brown suffusion; stigma short-oval, dark brown; veins brownish black. Wings relatively narrow. Venation: Sc_1 ending about opposite two-fifths Rs , Sc_2 some distance from the tip of Sc_3 , the latter approximately equal to $m-cu$; Rs long and very little arcuated; R_2 subequal to R_{1+2} and a trifle longer than R_{2+3+4} ; R_{3+4} nearly straight, the tip of R_5 deflected strongly to the wing-tip, cell R_4 thus suddenly widened at outer end; $m-cu$ at about one-half its length beyond the fork of M .

Abdominal tergites brown, blackened laterally, the sternites obscure yellowish brown; hypopygium dark. Sternal pocket well-developed. Male hypopygium with the basistyle relatively stout, the lateral spine long and acute, before the needle-like tip with numerous setæ. Outer dististyle bifid, the basal portion enlarged, darkened, with numerous setæ, the long lateral arm a slender gently curved rod that narrows very gradually to the acute spinous tip, immediately before this tip with about four setæ; inner arm a shorter needle-like spine. Inner dististyle small, bifid, the longer arm a flattened blade that terminates in two blackened spines. Ædeagus relatively narrow, produced into a gently curved black spine, before this spinous apex with three prominent setiferous tubercles.

Habitat.—Guatemala.

Holotype, ♂, San José, Lago Peten, November 13, 1925 (A. M. Dampf); M. F. No. 797.

Teucholabis furva is well-distinguished by the combination of characters diagnosed above.

Teucholabis (Teucholabis) miniata, new species.

General coloration of head and thorax reddish brown; mesonotal præscutum without dark markings or with these vaguely defined; thoracic pleura with a narrow dorsal black longitudinal stripe; halteres infuscated, the knobs blackened; femora obscure yellow, the tips blackened; wings weakly darkened, with very vague more whitish crossbands; male hypopygium with the basistyle extended into a long slender rod; outer dististyle with an erect spine before midlength; inner dististyle with the broad apex bispinous.

MALE.—Length about 5.5 mm.; wing 5.3 mm.

FEMALE.—Length about 5.5 mm.; wing 5 mm.

Rostrum reddish brown, shorter than the head; palpi black. Antennæ black; flagellar segments oval, gradually decreasing in size outwardly; verticils of outer segments becoming more elongate. Head dark reddish.

Pronotum reddish yellow. Mesonotal præscutum reddish, nitidous, in male without distinct markings, in the female with the cephalic portion of a median and posterior portions of lateral dark stripes slightly indicated; scutal lobes more or less darkened; posterior sclerites of mesonotum reddish. Pleura reddish, with a relatively narrow black longitudinal stripe, dorsal in position, extending from the anepisternum caudad, passing above the halteres to the abdomen. Halteres brown, the knobs blackened. Legs with the coxæ and trochanters reddish; femora obscure yellow, broadly black at tips, the amount subequal on all the legs; tibiæ pale brown, the tips and the tarsi more blackened. Wings with the ground-color weakly darkened, with very vague more whitish-hyaline crossbands, including the wing-base and areas before and beyond the cord; stigma dark brown; a somewhat paler brown seam on anterior cord; veins dark brown. Costal fringe relatively long and dense. Venation: *Sc* long, *Sc*₁ ending just beyond midlength of *Rs*, *Sc*₂ some distance from its tip (♀), closer to tip (♂), this character probably variable; cell 1st *M*₂ relatively small, subequal to vein *M*₄ beyond it; *m-cu* just beyond fork of *M*.

Abdomen dark brown, the sternites more bicolorous, brown, the caudal margins of all but sternite six more yellowish; hypopygium obscure yellow. Sternal pocket conspicuous. Male hypopygium with the basistyle produced into a long yellow spinous rod that terminates in a glabrous black spine, the surface of the rod densely hairy; margin of style near apex with a blackened flange, weakly roughened on margin but not distinctly serrate. Outer dististyle a long dark rod, narrowed to a spinous point, before midlength with a long acute broad-based spine, arising from the style at a right angle, the base with numerous setæ. Inner dististyle with the broad apex bispinous. Ædeagus broad basally, the distal two-fifths a slender rod.

In the female the abdomen is more uniformly darkened, the genital segment obscure yellow. Ovipositor with the tergal valves yellow, strongly upcurved, blackened at bases.

Habitat.—Panama.

Holotype, ♂, Changuinola District, United Fruit Company, October 3, 1925 (F. W. Walker).

Allotopotype, ♀. Paratopotype, a broken specimen, probably a ♂.

Type in the Museum of Zoology, University of Michigan.

Teucholabis miniata is very distinct from other regional species in the vaguely cross-banded wings which at first sight appear to be almost uniformly suffused with pale brown but in reality are slightly cross-banded with whitish.

***Teucholabis (Teucholabis) submolesta*, new species.**

Head dark, pruinose; mesonotal præscutum black, the humeral region and a small area at the suture yellow; halteres black throughout; wings whitish, the base light yellow; stigma oval, dark brown, conspicuous; *Sc* short, *Sc*₂ exactly opposite origin of *Rs*; abdomen black; male hypopygium with a black spine on mesal face of basistyle.

MALE.—Length about 4 mm.; wing 4.4 mm.

Rostrum about one-half the length of remainder of head, black; palpi black. Antennæ black throughout; flagellar segments oval, becoming smaller outwardly. Head black, with a gray pruinosity; anterior vertex broad.

Pronotum pale yellow. Mesonotal præscutum with the disk largely covered by three confluent black stripes, the humeral region restrictedly brownish yellow; a median yellow area just before the suture; scutal lobes black, the median area yellow; scutellum yellow; post-notal mediotergite black, pale laterally. Pleura largely pale with a dorsal black stripe that includes the dorsal anepisternum, pteropleurite and the pleurotergite; dorso-pleural region yellow. Halteres black throughout. Legs with the fore coxæ yellowish brown; remaining coxæ paler; trochanters yellow; femora brownish yellow, the tips narrowly darkened, especially the fore femora; tibiæ brown, the tips blackened; tarsi black, the proximal half of the basitarsi paler. Wings whitish, the base light yellow; stigma short-oval, dark brown, very conspicuous; veins brownish black. Venation: *Sc* unusually short, *Sc*₁ ending slightly beyond the origin of *Rs*, *Sc*₂ exactly opposite this origin; *R*₂ more than twice *R*₁₊₂; *R*₃₊₄ diverging strongly from *R*₅, cell *R*₄ at margin about one-half wider than cell *R*₂; cell 1st *M*₂ closed; *m-cu* not far beyond the fork of *M*; cell 1st *A* rather evidently constricted at near midlength.

Abdomen black, the surface vaguely pruinose; sternites dark. Male hypopygium with the basistyle stout, on mesal face beyond the insertion of the dististyles with an acute black spine.

Habitat.—Mexico (Nayarit).

Holotype, ♂, between Portesuelo and Ixtlan, March 12, 1927, flying at sunset (A. M. Dampf); M. F. No. 1184.

Teucholabis submolesta bears a superficial resemblance to

T. molesta Osten Sacken but is quite distinct, especially in the darkened halteres and details of the venation.

Genus *Neognophomyia* Alexander

Neognophomyia panamensis, new species.

Size small (wing, about 4.5 mm.); head yellow; mesonotal præscutum yellow with three dark stripes, the lateral pair blacker; pleura with a black dorsal stripe; wings subhyaline, with a narrow dark crossband along the cord; cell *2nd A* narrow; male hypopygium with the lateral extensions of the tergite appearing as pale rods, a little expanded outwardly, thence narrowed to elongate points.

MALE.—Length about 3.5–3.8 mm.; wing 4.2–4.5 mm.

FEMALE.—Length about 5–5.5 mm.; wing 4.5 mm.

Rostrum and palpi yellow, the outer segments of the latter passing into brown. Antennæ brown; flagellar segments long-oval with verticils that exceed the segments. Head yellow, the vertex somewhat darker behind, the genæ and postgenæ infuscated.

Pronotum blackened, the anterior lateral pretergites light yellow. Mesonotal præscutum with three shiny black or brownish black stripes; in most cases the lateral stripes more intense than the pale median area; lateral stripes crossing the suture and covering the lateral portions of the scutal lobes; median region of scutum obscure yellow; scutellum yellowish testaceous, darker laterally; postnotal mediotergite chiefly pale. Pleura with an intense black dorsal stripe extending from the propleura, traversing the dorsal pleurites to the postnotum; ventral pleurites pale. Halteres light brown, the knobs darker. Legs with the coxæ and trochanters yellowish testaceous; femora yellow, the tips narrowly and weakly infuscated; tibiæ and basitarsi yellow, the tips narrowly darkened; terminal tarsal segments uniformly darkened. Wings subhyaline with a narrow dark crossband at the cord, extending from costa to cell *1st M*₂, gradually narrowed posteriorly; narrow and vague dark seams along vein *Cu* and outer end of cell *1st M*₂; veins brown. Venation: *Sc*₁ ending opposite *R*₂, *Sc*₂ at near midlength of *Rs*; *R*₃ subequal to *R*₂₊₃; cell *2nd A* short and narrow.

Abdomen with the basal tergites bicolorous, pale basally, more darkened apically; fourth tergite more extensively yellow; succeeding segments uniformly blackened; genitalia yellowish brown; sternites more uniformly pale. Male hypopygium with the inner arm of the dististyle relatively slender, terminating in a bristle that is weakly fasciculate; outer arm of style terminating in a blunt tubercle. Phallosome a flattened plate, gently narrowed outwardly, the apical margin weakly emarginate. What appears to represent lateral arms of the tergite, but which in earlier papers were considered as being dorsal interbasal structures, appear as pale rods, slightly expanded toward outer end, thence narrowed to an elongate point.

Habitat.—Panama.

Holotype, ♂, Tonosi, Los Santos, September 18, 1925 (F. W. Walker).

Allotype, ♀, Changuinola District, United Fruit Company, October 2, 1925 (F. W. Walker). Paratopotypes, 1 ♂, 1 ♀.

Type in the Museum of Zoology, University of Michigan.

Neognophomyia panamensis is distinguished by the features listed above, more notably the small size, narrow cell *2nd A* and structure of the male hypopygium.

Genus *Gonomyia* Meigen

Gonomyia* (*Progonomyia*) *patrueilis, new species.

Allied to *G. (P.) hesperia* Alexander; wings with a brownish tinge, the subtriangular stigma darker brown; *Sc* long; *R*₂ beyond the point of departure of vein *R*₄; male hypopygium with the inner dististyle having the basal half setiferous, the distal half strongly narrowed.

MALE.—Length about 4 mm.; wing 4.8 mm.

Rostrum and palpi black. Antennæ with the basal segment obscure yellow, the remainder broken. Head brown, the anterior vertex and posterior orbits clearer gray.

Pronotum dark brown, with a yellow median spot behind, the caudal margins narrowly pale. Mesonotal præscutum with four brown stripes, the interspaces dusky, the humeral and lateral regions yellow; pseudosutural foveæ triangular; scutum dark brown; scutellum paler brown; postnotum dark gray, the cephalic lateral angles of the mediotergite obscure yellow. Pleura dark-colored, the dorsal region brownish gray, the ventral portion, including the sternopleurite, more brownish, the two dark areas enclosing a conspicuous whitish longitudinal stripe that extends from behind the fore coxæ to above the posterior coxæ, interrupted at the pteropleurite. Halteres dark brown, the base of the stem narrowly pale. Legs with the coxæ obscure yellow, darker basally; trochanters obscure yellow; femora brownish yellow, the tips a little darkened; tibiæ pale brown, a little darker distally; tarsi dark brown, the proximal ends of basitarsi paler. Wings with a brownish tinge, the subtriangular stigma darker brown; veins dark brown. Venation: *Sc* long, *Sc*₁ extending to about opposite four-fifths the length of the very long arcuated *Rs*; *R*₂ about one and one-half times the length of *R*₁₊₂, *R*₃₊₄ being reduced to a short section; *R*₅ straight, more than one-half *R*₄; cell *2nd M*₂ a little longer than its petiole; *m-cu* close to the fork of *M*.

Abdomen dark brown. Male hypopygium with the apices of the basistyles produced caudad beyond the point of insertion of the dististyles, the tip with two or three very powerful setæ. Outer dististyle a powerful smooth chitinized rod, the base dilated, thence gradually narrowed to the

long subacute apex, the surface glabrous. Inner dististyle elongate, the basal half stouter, its lateral face densely setiferous and produced at apex into a small stout spine; the distal half begins at this point as a slender narrowed spine, at its base on the mesal face a little produced and weakly spinulose. *Ædeagus* with the apex suddenly narrowed.

Habitat.—Mexico (Yucatan).

Holotype, ♂, Payo Obispo, Quintana Roo, September 16, 1925 (A. M. Dampf); M. F. No. 682.

***Gonomyia (Lipophleps) prolixistylus*, new species.**

Belongs to the *manca* group; antennal scape yellow, flagellum black; thoracic pleura striped; wings with a strong brownish tinge, especially the radial cells; cell 1st M_2 closed; male hypopygium with the tips of the basistyles moderately produced beyond the level of the dististyle; inner dististyle a very long slender curved rod; phallosome entirely pale, asymmetrical.

MALE.—Length about 3.5 mm.; wing 3.6 mm.

FEMALE.—Length about 4 mm.; wing 4 mm.

Rostrum and palpi black. Antennæ with the scapal segments yellow, the flagellum black. Head yellow, the center of the vertex infuscated.

Pronotum yellow. Mesonotal præscutum brown, vaguely pruinose, the lateral margins bright sulphur-yellow; pseudosutural foveæ shiny chestnut brown; scutal lobes dark brown, the median area obscure yellow; scutellum yellow, with a dark brown median area; postnotum sulphur-yellow, darker posteriorly and with a conspicuous brown basal triangle. Pleura dark brown, with a broad yellowish white longitudinal stripe extending from behind the fore coxæ, passing beneath the halteres, margined ventrally with a narrow purplish line. Halteres brown, the knobs obscure yellow. Legs with the coxæ pale brown, the middle coxæ darkened at base; trochanters yellowish brown; remainder of legs brown, the terminal tarsal segments darker brown. Wings with a strong brown tinge, the radial cells darker; stigma a trifle darker brown; veins darker brown. Venation: *Sc* moderately long, Sc_1 ending a short distance before the origin of *Rs*, the distance between the two about equal to *m-cu*; Sc_1 alone longer than *m-cu*; *Rs* short; cell 1st M_2 closed; *m-cu* before the fork of *M*.

Abdomen yellowish brown, the caudal margins of the segments a little darker; sternites and hypopygium brownish yellow. Male hypopygium with the apices of the basistyles produced beyond the point of origin of the dististyles into a stout fleshy lobe that is about one-half longer than the fleshy dististyle, provided with long conspicuous setæ. Two dististyles, the outer a small fleshy arm that terminates in two unequal fasciculate setæ and additional smaller setulæ; inner style a very long slender simple rod, strongly curved at near one-fourth the length, thence gradually narrowed to the acute tip. Phallosome entirely pale, asymmetrical, irregular in outline, without paired blackened hooks as in *scimitar*.

Habitat.—British Honduras.

Holotype, ♂, Blue Creek, October 7, 1925 (A. M. Dampf); M. F. No. 695.

Allotopotype, ♀. Paratopotypes, ♂♀, October 7–13, 1925 (A. M. Dampf); M. F. No. 695, 717.

G. (L.) prolizistylus agrees most closely with *G. (L.) scimitar* Alexander, from which it differs especially in the much longer and more slender inner dististyle and the entirely pale phallosome. *G. (L.) producta* Alexander has a very similar inner dististyle but the apical lobe of the basistyle is greatly produced into a long fleshy lobe.

Genus *Erioptera* Meigen.

***Erioptera (Mesocyphona) whitei*, new species.**

General coloration dark brown, variegated with paler; second scapal segment enlarged; femora yellow with a subterminal brown ring; wings brownish subhyaline, immaculate; male hypopygium with a single powerful dististyle that is split into two divaricate arms, the outer more slender and spinous.

MALE.—Length about 2.5–2.6 mm.; wing 2.4–2.6 mm.

FEMALE.—Length about 2.8–3 mm.; wing 2.7–2.8 mm.

Described from alcoholic specimens.

Antennal scape dark brown, the flagellum paler; second scapal segment enlarged, oval, much larger than the basal segment; flagellar segments crowded. Head chiefly dark brown, paler on the front and region of the anterior orbits.

Mesonotum chiefly dark brown, variegated with paler, this usually including the præscutal stripes and centers of the scutal lobes. Pleura dark brown, with a narrow longitudinal pale stripe. Halteres pale. Legs with the coxæ and trochanters testaceous yellow; femora yellow, with a diffuse brown subterminal ring; tibiæ and tarsi brownish yellow, the terminal tarsal segments passing into brown. Wings brownish subhyaline, immaculate; veins darker. Venation: Cell M_2 open by atrophy of the outer deflection of M_3 ; $m-cu$ about one-half to one-third its length before the fork of M .

Abdomen, including the hypopygium, dark brown. Male hypopygium with a single powerful dististyle, the stem stout, at apex split into two arms that diverge almost at a straight angle, the outer arm a slender curved spine, the inner arm a more flattened blade. Gonapophyses appearing as simple, nearly straight, blackened rods that narrow to the subacute tips.

Habitat.—Guatemala.

Holotype, alcoholic ♂, Bananera, November, 1928 (J. J. White).

Allotopotype, ♀. Paratopotypes, numerous ♂, ♀, alcoholic, in collection of the author and Mr. Charles F. Clagg.

We are indebted to Dr. Crampton for the opportunity of describing this very distinct species which is named in honor of the collector. In the leg-pattern, the species agrees most nearly with *E. (M.) immaculata* Alexander, differing notably from this and all other described species in the structure of the male hypopygium.

PRELIMINARY NOTES ON CERTAIN PHASES OF
THE BEHAVIOR AND HABITS OF PRO-
CERATIUM CROCEUM ROGER

BY CARYL PARKER HASKINS

Because of the great kindness of Dr. M. R. Smith, of the State Plant Board of Mississippi, who repeatedly and generously supplied the writer with living queens and workers of the rare hypogeaic ant *Proceratium croceum* Roger (Ponerinae, Proceratii) it has been possible to subject living colonies of the ant, housed in modified Lubbock nests, to daily observations for more than a year. While innumerable problems of behavior and of general biology remain to be solved, it has seemed to the writer that sufficient material has accumulated, considering the nature of the species, to warrant a preliminary presentation of it at this time, in the hope that it may be of some interest to those concerned with our American hypogeaic Ponerinae.

NESTING HABITS AND THE FORMATION OF
NEW COLONIES

Such notes as are presented concerning the nesting sites and the characteristics of adult colonies of *Proceratium croceum* were generously placed at my disposal by Dr. Smith, and refer to the ant in Mississippi.

Like most of the hypogeaic Ponerines, *Proceratium croceum* habitually associates itself with glade or deep-woods ants, seeking the less severe competition of silvicolous areas. In forested or relatively wooded land the adult colonies are excavated in moist fallen timber by preference, the rambling galleries and poorly finished chambers giving no external evidence of their existence. The colonies are often rather small, ranging from a very few workers associated with an alate queen up to twenty or so, but in favorable situations the colonies may be much larger than this, as with others of the Proceratii and Amblyoponae. It is probable that under natural conditions the workers are prac-

tically strictly hypogeaic, but individuals colonized in artificial nests exhibited such a marked tendency to emerge occasionally into the open air, thereafter returning underground, as to leave some suspicion that they may occasionally do this under natural conditions.

In Mississippi the adult colonies bring their winged forms to maturity in August, and these are produced occasionally in no inconsiderable numbers. Dr. Smith took from a single colony between twenty and thirty winged queens; this same community containing a number of males, hitherto undescribed. The young queens are completely pigmented before attempting the nuptial flight. They dealate themselves rather readily if the flight is artificially delayed. A group of six young queens sent to the writer while in the winged condition dealated themselves *en route* and thereafter behaved precisely like fertile females.

There is considerable evidence that young females of the species are quite capable of and accustomed to forming new colonies without assistance, in the fashion typical of higher ants. Young fertile queens artificially nested together in damp wood have repeatedly separated and built individual cells, which were finished and closed in the fashion typical of higher queens. Several of these young queens thus isolated in December have produced eggs the following March, which they attended carefully and hatched. They were artificially fed during the intervening period, but there was every evidence that the fat body, reinforced by the diminishing wing-muscles, alone would have sufficed to produce the eggs and probably to rear a few minute larvæ.

LENGTH OF DEVELOPMENTAL PERIOD, AND CARE OF THE LARVÆ

Notes taken on the developmental periods of the young are at present almost wholly incomplete, owing to the fact that no larvæ have as yet survived to maturity under artificial conditions. Three eggs laid by young fertile queens hatched in twenty, twenty, and twenty-one days respectively. *Proceratium* shows little tendency to devour ova, and this fact combined with the circumstances that the adults in laying colonies were kept con-

stantly full fed has, the writer believes, diminished the chance which is always present in the determination of the incubation period of ant ova, that the eggs which were observed to hatch were not those observed as laid, the original specimens having been devoured and others immediately deposited in their place. The incubation periods for infertile ova were substantially the same, three eggs laid by unfertilized queens hatching in twenty-one, twenty, and, curiously enough, eleven days respectively. It is probable that the abnormal recording was caused by some unchecked error of observation. The temperature of incubation was a mean of about 23° C.

Proceratium croceum pays much attention to the eggs, whether they be laid and tended by a single fertile female, or in a large colony. They are carefully licked and carried about, and usually agglutinated in small packets. The larvæ, when hatched, are left on the egg packet for three or four days, and during this period are not differentiated by the nurses from unhatched ova. The larvæ are short and thick set, with large heads, and are noticeably inactive. They show no tendency to devour unhatched eggs, and during the first week of life give no indication of hunger, nor are they, so far as could be observed, fed. When about a week old, the larvæ are removed from the unhatched eggs, and are then placed on whatever food may chance to have been brought into the brood chamber. Even at this stage they show none of the activity usual to Ponerine larvæ, but attach themselves to their victims and remain in this position for days, feeding extremely slowly. While feeding they are eagerly licked for exudates, and some indication has been seen of a tendency to pinch them to hasten the flow. When full-fed they drop from their victims, more after the fashion of the larvæ of solitary wasps than of ants, and are then allowed to lie singly on the chamber floor. Growth, under artificial conditions at least, is extremely slow. The larvæ have never been seen to move, their complete immobility reminding one strongly of the behavior of many Myrmicine larvæ, and contrasting strangely with their thoroughly entomophagous habits. No verifiable case has been seen by the writer in which any attempt was made by a nurse to feed the larvæ by regurgitation, although the mouth and the first

thoracic segments of the larvæ were often assiduously licked, perhaps to obtain a minute quantity of saliva present with the exudates.

When disturbed, the brood nurses eagerly seize both eggs and larvæ and hurry away with them. When undisturbed, however, they showed an increasing tendency to neglect the larvæ more and more as the latter grew older, and in every case the young when two or three months old were no longer placed on the insect material brought into the nest to be devoured by the adults. The young made no attempt to help themselves, but shriveled and soon perished, when they were either thrown away or devoured by the nurses.

SOCIAL HABITS

The relations of the adults of *croceum* to one another, though primitive, are yet more complex than might at first appear. Foraging is done by single workers, and appears to be confined entirely underground. The ants are wholly entomophagous. Honey and sweet materials of all kinds are not recognized as edible. Larvæ of *Lasius americanus*, *Lasius umbratus*, *Camponotus americanus*, and *Stigmatomma pallipes* were eagerly accepted in the artificial nest. Cocoons of the first-named species were opened by a few individuals and the pupæ extracted, a fact possibly significant of relations between adults and pupæ about to be enclosed, although there seems little doubt that the latter may escape without assistance if required to. After repeated trials, meat was accepted as edible by a few individuals after marked hesitation.

Under artificial conditions, foraging individuals exhibit the curious habit, when prey is discovered, of reversing their position and backing up to it to insert their stings, instead of attempting to seize it with the mandibles. This behavior has been repeatedly observed, but whether it is practiced in the wild state can only be surmised, together with the means whereby the intended prey is induced to remain motionless during the lengthy procedure. The prey having been stung, it is dragged to the brood chamber by the mandibles in usual fashion, and there devoured and covered with the larvæ.

No indication of regurgitation has been seen between adults, although there is a clear foreshadowing of it in the habit frequently seen of licking the gula and interlocking divaricated mandibles while soliciting with the forefeet. The habit of deportation is strongly developed, although it is extremely generalized and undertaken without precision. The individual to be deported is seized by the mandibles, or by the posterior margins of the head, or by the petiole, or by the first or second gastric segments, and forcibly dragged. It is significant, however, that the individual deported frequently makes no attempt to escape, but submits quiescently to the treatment. It has never been seen employed in times of danger, but is to be noticed at most other times, especially when the ants are feeding on prey newly brought in. Dr. Smith has observed a much more elaborate and precise form of deportation, rather closely resembling the habit of *Leptothorax*, though undertaken apparently with no definite purpose in view. The ants concerned locked mandibles, and the deported individual bent the body, dorsal side up, over that of its porter.

Fertile females are given no special attention in the colony, and it does not seem possible to differentiate them from the worker personnel in point of activity or skill in nest duties. Some individuals, to be sure, are somewhat more sluggish than the workers, and this is perhaps more true of old females in established colonies, but many individuals are both more active and more skillful in carrying on nest activities than the bulk of their workers, and the major portion of labor may devolve upon them.

The integrity of colonies is well preserved, alien individuals being quickly detected and attacked. It is also significant that young queens, a few weeks after their flight, are no longer recognized by their own sisters or by the workers of their old colonies.

The brood-chambers are kept clean and free from foreign material, but little tendency has been seen to establish kitchen-middens. Foreign particles are sometimes buried in the chamber walls, but more often are carried afield and deposited in an unused gallery. Dead adult members of the colony are carefully taken to the point furthest removed from the living nest, and

left there. The usual reaction, apparently so universal among ants in general, of depositing earth upon moist spots in the nest, is present.

SENSES

Little can be said at the present time on this score, not because of lack of good evidence, but because of lack of a sufficient quantity of it, and of sufficient precision in it. As with all hypogeaic ants, the topochemical sense clearly predominates, and some idea of its delicacy may be gained through the perception of apparent odor-change in young queens already mentioned. The instant rejection of all but a very limited class of foodstuffs vividly indicates the degree of development of the sense of taste. Touch, because of the rather general distribution of the nerve-hairs, is both general and rather delicate. The touch of the antenna of a passing ant upon a resting sister will usually arouse it at once, regardless of the portion of the body with which contact is made.

The sense of sight, though feebly developed, is clearly present, and repeated tests with Wratten filters have convinced the writer of the inability of the ants to perceive the red rays, but the precise wave-length which limits perception is difficult to discover, both because of its probable high variability from individual to individual, and because of the impossibility of deciding whether in a given case the impulses of the ant are completely expressed in visible fashion. Fear, familiarity or unfamiliarity with surroundings, temperature and individual temperament add their difficulties to detract from precision.

After a rather extended and careful series of experiments, the writer has thoroughly convinced himself of the ability of *croceum* to perceive certain sound wave-lengths within the human sound-spectrum. These remain to be further elaborated and still further safeguarded from the error due to incomplete isolation of mechanical vibration before they may be presented.

INSECTS AND WITCHCRAFT

BY HARRY B. WEISS

NEW BRUNSWICK, N. J.

“It is one of the obligations that witches owe to the devil that, when they assemble at the Sabbat, they must show that they have wrought some fresh evil since the last meeting; and if they cannot do so they escape with impunity. And that they may not be able to plead ignorance as an excuse, their evil Master instructs them in all those activities which he demands from them: as in infesting the trees and fruits with locusts, caterpillars, slugs, butterflies, canker-worms, and such pestilent vermin which devour everything, seeds, leaves and fruit; or in bewitching cattle; or in casting a spell on the crops so that they are destroyed by leeches or wasted in some other way; or in the use of poisons, and in working as far as in them lies for the destruction of the whole human race. For all this we know from their own confessions.” So wrote Brother Francesco Mario Guazzo in 1608 in chapter VIII of his “Compendium Maleficarum.”

This little paper is not concerned with black magic as such, but rather with the relatively unimportant part which insects played in witchcraft and more particularly with their use as familiars or demons in the shape of animals, by means of which spirits, the witch was served in carrying out her nefarious plans. Kittredge has stated, “that the essential element in black witchcraft is *maleficium*—the working of harm to the bodies and goods of one’s neighbors by means of evil spirits or of strange powers derived from intercourse with such spirits. This belief in *maleficium* was once universal; it was rooted and grounded in the minds of all European people before they became Christian; it is still the creed of most savages and of millions of so-called civilized men.”

Beelzebub, or the lord of flies, was an ancient deity worshipped under the form of a fly. Aelian (*de Natura Animalium*) states that during a festival in honor of Apollo, an oxen was sacrificed

to flies, and Pliny mentions a divinity as being invoked for relief from their annoying visits. Dalyell, in his "Darker Superstitions of Scotland," wrote that a "tutelary fly, believed immortal, presided over a fountain in the county of Banff and here also a large blue fly, resting on the bark of trees, was distinguished as a witch." In northern mythology, Loki, the spirit of evil, is said to have metamorphosed himself into a fly and fiends in the shape of flies were kept in captivity by the Finlanders, to be released against men and beasts. Dalyell relates also that when the Archbishop of St. Andrews was murdered in 1679, "upon the opening of his tobacco box a living humming bee flew out," which was thought to be his familiar or devil. During the trial of Isobell Elliot, Marion Veitch and others, September 13, 1678, "a woman declared that a child was poisoned by its grandmother, who, together with herself, were 'in the shape of bumblebees,'—that the former carried the poison 'in her cleuchs, wings, and mouth.'" Dalyell cites other instances of black beetles being considered as metamorphosed devils, comparing this belief in Scotland with that of the ancients, as recorded by Pliny, in associating nocturnal moths fluttering around their lamps, with an evil presence. He believed that the modern superstitions regarding demoniac insects were perhaps derived from the stories of Jewish history, as literally accepted (Exodus, Chap. XXIII, V. 28; Wisdom of Solomon, Chap. XV, V. 8; Deuteronomy, Chap. VII, V. 20; Joshua, Chap. XXIV, V. 12).

According to Karsten, the spirits and demons of the South American Indians sometimes assume the shapes of insects. Among the Araucanians, horse-flies are regarded as spirits from the shade-land. If such insects enter a village where some one is sick, the Indians begin to wail as if death had already occurred, saying that "the horse-flies are the souls of their dead relatives who are coming to fetch him away." The appearance of these insects at their drinking bouts indicates that their dead kinsmen are taking part in the feast, and it is believed that chiefs especially transform themselves into horse-flies and remain in this shape in the grass, emerging sometimes to visit their relations. Among the Jibaros and Canelos Indians, certain venomous insects are regarded as demons and the Canelos pay particu-

lar attention to the "black wasp" and the "great black ant," the poisonous stings of which are thought to resemble the magical arrows of the sorcerers.

Winstedt, writing of Malay magic, says that a class of familiar spirits is created from the dead, the best known of these taking the shape of a house-cricket. A woman enters the forest on the night previous to a full moon and with her back to the moon and her face to an ant hill, recites a charm and tries to capture her own shadow. This may require three nights or she may have to try for several months always on the same three nights. Finally she succeeds and never again will her body cast a shadow. Then in the night a child will appear before her and put out its tongue. She seizes the tongue, the child's body vanishes and the tongue transforms into a tiny animal, reptile, or insect which may be used as a bottle imp. Another version is that a tongue to change into such an imp "must be bitten out of the exhumed corpse of the first born child of a first born mother and buried at cross roads." Such vampire crickets are employed by jealous wives to work harm to their rivals or to their rivals' children. Bottle imps are kept in closed bamboo vessels and fed with milk and ant's eggs. When released, a bottle imp will cause sickness, delirium, etc., especially to children, the best known of such imps taking the form of house-crickets.

Kittredge, in his recent work "Witchcraft in Old and New England," cites many instances of demons in the shape of insects, serving the witch as familiar spirits. He writes that "among the Bakongo, insects trapped by the doctor are witches who have caused disease: if the insect is hurt, the witch suffers." When John Steward of Knaresborough (Yorkshire) was tried for sorcery in the Archbishop's Court in 1510, one of the witnesses testified that he had been told by a Sir Thomas Spurret, "that he sawe Stewerd have iii humble bees, or like humble bees, and kepte theyme undir a stone in the erth, and called theyme oute by oone and oone, and gave iche oone of theyme a drop of blode of his fyngor."

According to the "Depositions from the Castle of York relating to offences committed in the Northern Counties in the seventeenth century" (Surtees Society, vol. XL, p. 67, London,

1861), John Greencliffe of Beverley, on October 14, 1654, said "that on Saturday last, about seaven in the evening, Elizabeth Roberts did appeare to him in her usuall wearing clothes, with a ruff about her neck, and, presently vanishing, turned herself into the similitude of a catt, which fixed close about his leg, and, after much struggling, vanished; whereupon he was much pained in his heart. Upon Wednesday there seized a catt upon his body, which did strike him on the head, upon which he fell into a swoound or traunce. After he received the blow, he saw the said Elizabeth escape upon a wall in her usuall wearing apparell. Upon Thursday she appeared unto him in the likeness of a bee, which did very much afflict him, to witt, in throwing of his body from place to place notwithstanding there were five or six persons to hold him downe." All of which Elizabeth Roberts denied.

Cotton Mather, in "The Wonders of the Invisible World" (1639), wrote that at the trial of Rose Cullender and Amy Duny in New England, Margaret Arnold testified,—“At another time, a thing like a Bee, flew at the Face of the younger Child; the Child fell into a Fit; and at last Vomited up a Two-penny Nail with a Broad Head; affirming, That the Bee brought this Nail, and forced it into her Mouth. The Child would in like manner be assaulted with Flies, which brought Crooked Pins unto her, and made her first swallow them, and then Vomit them.” During the same trial, Robert Sherringham testified among other things that while driving past Rose Cullender's house, “He was also taken with a Lameness in his Limbs; and so vexed with Lice of an extraordinary Number and Bigness, that no Art could hinder the Swarming of them, till he burnt up two Suits of Apparel.”

Guazzo, in his "Compendium Maleficarum," discussing whether witches could create living things, wrote,—“It is the opinion of S. Augustine (*De Trinitate*, III, 7) supported by all other Theologians, particularly S. Thomas and S. Bonaventura, that witches can in a moment produce imperfect animals, such as flies, worms, frogs and such insects and other animals which are generated by putrefaction; not by creating them, but by applying active to passive principles. It is usually the

demon who, in accordance with his pact with the witch, produces such animals by the application of active to passive forces: for the witches themselves for the most part do not know how they are produced, and are ignorant of the causes: as when the devil gives a witch a little dust which she throws into the air, and there are born various kinds of locusts and grasshoppers and mice and caterpillars and suchlike animals. The devil could also, having produced such things, tend them and nourish them and give them breath in remote places where they appear to be generated; as among rocks, where imperfect animals are often born, such as flies and mice and similar things."

In another place, Guazzo, speaking of the tenacious grip which the devil keeps upon those in his power, said,—“Among many other women condemned to the fire for witchcraft, whose names I do not now remember, when Claude Simonette and her son were led into prison it was observed that a demon in the form of a fly buzzed round their temples and repeatedly warned them not to lay their crimes bare by confession even under stress of the direst torture: for if they confessed, it was most certain that they would be condemned to the most terrible death; whereas if they held their tongues they would shortly escape safe and unharmed."

In "Witch Hunting and Witch Trials," by C. L'Estrange Ewen, which includes abstracts of the indictments for witchcraft in England from 1559 to 1736, the following references to insects may be found.

"Joan Wayte of Grt. Barneston, spinster, wife of Robert W. of B., labourer, on 29 Aug., 1650, at Audleyend, did entertain, employ, and feed an evil spirit called a butterfly."

And among various seventeenth century depositions occur the following:

"Alicia Warner de Rushmere ffely beeing at her liberty confessed that she had entertained certeine euill sperits w^{ch} had succed her and that she employed them to carry lice to one Wrights wife and to one barnies and the s^d. weamen weare lousie according as she confessed."

"Susanna Smith de Rushmere . . . confessed that the diuill did againe appeare to her in likenes of a black bee and told her

that she shold bee attached the next day and that if she confessed any thinge she shold die for it. . . .”

In accordance with the published rules for the discovery of witches, insects sometimes furnished a part of the evidence. John Gaul in his “Select Cases of Conscience touching Witches and Witchcrafts” (1646) gives some particulars of the method utilized by one Hopkins, a witch-finder.

“Having taken the suspected witch, she is placed in the middle of a room upon a stool or table, cross-legged, or in some other uneasy posture, to which if she submits not, she is then bound with cords; there is she watched and kept without meat or sleep for the space of 24 hours for (they say) within that time they shall see her imp come and suck. A little hole is likewise made in the door for the imp to come in at; and lest it might come in some less discernible shape, they that watch are taught to be ever and anon sweeping the room, and if they see any spiders or flies, to kill them. And if they cannot kill them, then they may be sure they are her imps.”

Many other references to insects of a demonic nature may be found in the literature of witchcraft. Kittredge states that flies of such kind are frequently mentioned in Germanic lore and that they are familiar to Lappish, Finnish and Norse sorcery. Of course, insects were not the most popular of animal familiars and they were greatly outnumbered by cats, dogs, toads, rats, ferrets, birds, mice, rabbits, etc.

From the middle of the thirteenth to the beginning of the eighteenth centuries such beliefs as are indicated above were a part of the times, and it was no more improper to hold such views then than it is now to believe in mediums, fortune tellers and other forms of present day quackery. Yesterday, we hanged witches. Today, we pay them consultation fees. *O tempora! O mores!*

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REMARKS ON "A LIST OF THE INSECTS
OF NEW YORK"

BY GEORG OCHS

FRANKFURT A. MAIN

Family Gyrinidæ

Dineutus MacLeay

(MacLeay, 1825, Ann. Jav. I, p. 30; 1833, Ed. II, p. 133, named his new genus *Dineutus*, not *Dineutes*, as used by later authors. Cf. Ochs, 1924, Amer. Mus. Nov. 125, p. 1.)

- 2671 *D. ciliatus* Forsb. 1821 (= *vittatus* Germ. 1824; cf. Ochs, 1925, Ent. Blätter, XXI, p. 174); White Plains Bno.; Valley Cottage, May, CU.
- 2674 *D. discolor* Aubé. Ithaca, May-Oct., CU; Ithaca, Fall Creek, Aug., CU; Wells, Je., Babiy-CU; Penn Yan, Cy-CU; NY, HHS-CU. L. I.: Wading River, Aug., Carnegie Museum.
- 2679 *D. nigrrior* Rob. Ithaca, Je., Aug., CU; White Plains Bno; Fulton, Je., CU; Adirondacks, Indian Lake, Je., Babiy-CU. L. I.: Wading River, Aug., Carnegie Museum.
- 2680 *D. assimilis* Kirby. (The name *americanus* was used by Linné in 1767 for a West Indian species = *metallicus* Aubé, 1838; cf. Ochs, 1927, Kol. Rundschau, XIII, p. 36.) Buffalo; Ithaca, Apr.-May, Jl.-Sept., CU; Ithaca, Cove, Sept., CU; Fulton, Jl., CU; L. I.: Wading River, Aug., Carnegie Museum.
- 2681 *D. hornii* Rob. White Plains Bno; Ithaca, Je., Aug., CU; Cinnamon Lake, Je., Babiy-CU; Fulton, Je., CU; Adirondacks, Indian Lake, Jl., Babiy-CU; St. Lorenz R., Alexandria Bay, Je., Babiy-CU; L. I.: Wading River, Aug., Carnegie Museum.
- 2682 *D. emarginatus* Say. S. I., AM.

Gyrinus Geoffroy

- 2684 *G. minutus* Fab. Ithaca, CU.
 — *G. rockinghamensis* Lec. NY, AM.
G. minutus and *G. rockinghamensis* must be separated; they are probably different species, at least the latter is a well distinguished varietal form.
- 2685 *G. confinis* Lec. Ithaca, Jl.-Sept., CU.
 2687 *G. aeneolus* Lec. Ithaca, Jl.-Sept., CU; NYC and vic. AM; SI.: AM.
- 2688 = 2690 *G. limbatus* Say. There is nearly no doubt for me that *G. elevatus* Lec. is the same as Say meant. It is collected chiefly in the Southern States and records from N. Y. seem to be doubtful.
- *G. latilimbus* Fall. Ithaca, Ap., Aug.-Sep., CU; Old Forge, Aug., CU.
- 2689 *G. dichrous* Lec. NY, AM.; Ithaca, CU.
 2691 *G. ventralis* Kirby. Ithaca, CU.
 2692 *G. aquiris* Lec. Ithaca, Ap.-May, Jl.-Sep., CU; Old Forge, Aug., CU; SI, AM.
- It seems to me, as Fall had already presumed, that *G. aquiris* and *G. consobrinus* are not specifically different. As seen in considerable material, all characters, which were hitherto regarded as distinctive, do overlap, so the species must take the older name: *consobrinus* Lec. (types from California). *Aquiris* (types from Middle States) may perhaps be retained for eastern specimens, if they are considered as a variety; the chief distinguishing characters, more straight truncature of elytra, body apically less narrowed, are, however, not constant.
- 2695 *G. maculiventris* Lec. Ithaca, CU.
 2696 *G. affinis* Aubé (= *striolatus* Fowl. 1887, cf. Zimmerm. 1926, Kol. Rundschau, XII, p. 97). Ithaca, Ap., Aug.-Sep., CU; Old Forge, Aug., CU; Cranberry Lake (H); L. I.: Wading River, Aug., Carnegie Museum.
- 2700 *G. analis* Say. Ithaca, Ap., Jl.-Aug., CU.

- 2705 *G. marinus* Gyll. does not occur in North America. The records given in the "List" under this number must be referred to another species.
- 2707 *G. borealis* Aubé. NYC and vic., AM; SI, AM.
- 2707a *G. lugens* Lec. is a distinct species and not to be confounded with *G. borealis* Aubé. Ithaca, CU; Old Forge, CU; McLean, May, Oct., CU; Tompkins Co., McLean Bogs, CU; NY, AM; L. I.: Wading River, Aug., Carnegie Museum.
- *G. frosti* Fall. Ithaca, Aug.-Sep., CU; White Plains Bno; NY, AM; SI, AM.
- *G. woodruffi* Fall. New York.
- *G. bifarius* Fall. Ithaca, Aug., CU.
- *G. lecontei* Fall. (Omitted in the "List!" Buffalo; Ithaca, CU.

NOTE: The above paper was submitted to Prof. H. C. Fall, who very kindly supplied the following statement.—*Ed.*

In a footnote on p. 262 of the "New York State List of Insects" I am credited with having read the manuscript of the list of Gyrinidæ, and the casual reader might reasonably infer that the list as there given was in accordance with my views, or at least met with my acceptance. Such is far from the case in the genus *Gyrinus*, in which the list followed the Leng "Catalog," and for which I requested an entire rearrangement in accordance with my 1922 paper on the genus. For some reason this was not done, the authors of the "List" contenting themselves with appending the new species at the end of the old list and adding a footnote to the effect that the sequence of species is that of the Leng "Catalog" and not that of my more recent Revision.

So far as *Gyrinus* is concerned the corrections indicated by Ochs in the above contribution are precisely those called for in my 1922 paper, except that in two cases of synonymy indicated by me as possible, he goes a step further and is inclined to accept them as established. To be specific, he expresses almost no doubt that *G. elevatus* Lec. is the same as Say's *limbatus*, and is ready to unite *acquiris* Lec. with *consobrinus* Lec.

I have given reasons in my paper for refraining from announcing the above possible synonymy as established, and may here add that had Say actually had *elevatus* in hand it seems highly probable that he would have observed and mentioned its notably more convex almost humped form relative to that of *analís* with which he compares it.

As regards *acquiris* and *consobrinus* there are still, so far as I know, no reliable records of *acquiris* from west of the Mississippi, nor of *consobrinus* from anywhere east of the Great Basin. The slight difference in the male genitalia noted by me needs also to be tested by further dissections before we can safely announce the identity of the two species.

H. C. FALL

SCARABÆIDÆ, COLEOPTERA; OBSERVATIONS ON
SPECIES UNRECORDED OR LITTLE-
KNOWN IN NEW JERSEY¹

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Since the 1909 edition of Smith's "Insects of New Jersey," three foreign beetles of the family Scarabæidæ have been identified and recognized as pests within the commonwealth. The studies of *Popillia japonica* Newm., *Phyllopertha orientalis* Waterh. and *Autoserica castanea* Arr. have necessitated rather careful investigations of the native members of the same family. These investigations involve not only the collecting and field observations of adult beetles, but the rearing of numerous unknown larvæ as well. Such activities have made it possible for the writer to add a number of names to the list of Scarabæidæ already recorded for New Jersey.

Of the 163 species mentioned in Smith's list, 117 records have been duplicated within the past five years and twenty-two additional species have been found. Of about forty-five species not relocated, probably some have become either locally extinct or extremely rare, owing to forest fires and to the encroachments of civilization. Others are likely restricted to limited areas not yet sufficiently examined at the proper seasons. It is to be remembered that with many insects the annual periods of specific abundance are very short; then, too, a species may become really common only at intervals of several years.

Southern New Jersey—the coastal plains region—has been more thoroughly studied than that portion of the state lying above the fall line. Practically all of the low country is composed of sand or gravel; much of it is covered with a wild growth of pines and oaks. Certain portions, as the Delaware Valley and a narrow strip along the coast, are characterized by old farm

¹ Contribution No. 74. Japanese Beetle Laboratory, United States Bureau of Entomology, Moorestown, New Jersey.

lands with pastures, wood-lots, orchards, fields and gardens. All this, with our mild climate, forms an excellent breeding ground for many Scarabæidæ. A number of southern species are included in our lowland fauna; while a few isolated hills, rising to perhaps 200 feet elevation, harbor several insects which are more likely to be met with in North Jersey or across the Delaware in Pennsylvania. Also, some things have been found which apparently did not adhere to any definite rule involving altitude.

It will be remembered that in a general way the scarab family is composed of two great groups; first, those species which subsist upon refuse organic matter, and second, those which in the adult stage feed upon living vegetable tissue—chiefly leaves, flowers and fruits. There is, however, a smaller group which seems to be transitional or at least intermediate. The food of these is fungi—chiefly if not exclusively of terrestrial forms. Of the twenty-two native Scarabæids to be added to Smith's list, ten belong to the first group, that is, they are coprophagous in habit; four, we believe, are strictly mycetophagous in habit; while the remaining eight are purely phytophagous. Below is a list of New Jersey scarabæids not mentioned in Smith's paper.

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|--|--|
| 1. <i>Onthophagus cribricollis</i>
Hn. | 11. <i>Odontæus darlingtoni</i>
Wallis |
| 2. <i>Aphodius erraticus</i>
(Linn.) | 12. <i>Odontæus simi</i> Wallis |
| 3. <i>Aphodius hæmorrhoidalis</i>
(Linn.) | 13. <i>Odontæus liebecki</i> Wallis |
| 4. <i>Aphodius crassulus</i> Hn. | 14. <i>Bolbocerosoma tumefac-</i>
<i>tum</i> (Beauv.) |
| 5. <i>Aphodius stupidus</i> Hn. | 15. <i>Serica carolina</i> Daws. |
| 6. <i>Aphodius lentus</i> Hn. | 16. <i>Serica opposita</i> Daws. |
| 7. <i>Aphodius campestris</i>
Blatch. | 17. <i>Serica lecontei</i> Daws. |
| 8. <i>Aphodius serval</i> Say | 18. <i>Serica georgiana</i> Leng |
| 9. <i>Aphodius prodromus</i>
(Brahm) | 19. <i>Serica cuculata</i> Daws. |
| 10. <i>Dialytes striatulus</i> (Say) | 20. <i>Phyllophaga diffinis</i>
(Blanch.) |
| | 21. <i>Phyllophaga subtonsa</i>
(Lec.) |
| | 22. <i>Anomala nigropicta</i> Csy. |

Onthophagus cribricollis Hn. was first reported for New Jersey by Charles Schaeffer. He collected two specimens at Lakehurst and published the record in the Journal of the New York Entomological Society for December, 1914, but gave no date. In the Frank Heimbach collection, we have two old specimens labeled "Five-mile Beach, N. J., April 20"—no year given. I found them in the series of *O. pennsylvanicus*. My own records began with June 25, 1926, when one was found under a rabbit pellet in the small Pine Barren at Rancocas Park, five miles from Mount Holly. Between that date and July 9, seventy specimens were collected under rabbit droppings in the same place; twenty-seven being taken on July 4. In 1927, fifty were collected in the same locality, all within an area one-eighth mile in diameter. The best days were July 20 and 21, on each of which twelve of the beetles were collected. All specimens were taken at rabbit pellets. Thus, two seasons' collecting resulted in 120 specimens. The beetles were most active on warm sunny days after showers, and practically all were found between 9 A. M. and noon. None was ever observed on the wing in the afternoon or on a cloudy morning. As in all species of *Onthophagus* whose habits are known to me, *cribricollis* buries its food where found and sinks it vertically to a depth of a few inches, where the subsequent grub lives in a double-walled plaster cell of its own manufacture. The entire metamorphosis was found to require about one month. As in other species, this beetle probably overwinters as a hibernating adult buried singly at a depth of several inches. One feature of *cribricollis* not hitherto mentioned in descriptions is that a well developed male has a distinct single median tubercle near the anterior thoracic margin, very similar to that of *O. anthracinus* Harold of the Southwest.

Aphodius erraticus (Linn.) is an introduced European species common in some of the higher portions of the Eastern States. Three specimens were found in a hillside cow pasture of the Watchung Mountains near Pluckamin, New Jersey, on May 28, 1925. Another individual was seen among the sand dunes at Seaside Park on a subsequent date not recorded. This is a lively, active species.

Aphodius hæmorrhoidalis (Linn.). An European species now quite abundant throughout New Jersey. My first date for it is May 20, 1925, when several were taken in a cow pasture near Freehold, New Jersey.

Aphodius crassulus Hn. A very small shining black species described from Florida and now added to the New Jersey list on the strength of two specimens taken by the writer in 1929. These were found in deer droppings in a moist thicket of the Pine Barrens between Medford and Indian Mills on June 3 and 11. Our two specimens differ slightly from those of Horn's small series in having the elytral intervals concave instead of flat. This produces an effect unique among *Aphodii* so far as I know.

Aphodius stupidus Hn. March 27, 1925, is, I believe, the first New Jersey date for this. On that day one beetle was collected at Rancocas Park by H. C. Hallock. My records—all for the same locality—begin with April 3, 1927, when one specimen was taken. None appeared during the summer but between October 7 and 31, fourteen additional ones were collected. *Stupidus* is a dull species both in appearance and actions.

Aphodius lentus Hn. is more generously represented. Eighteen individuals have been collected at Rancocas Park, the first date being May 25, 1927. That and the following year totaled three, the latest date being June 3. The year 1929 was more productive; eleven specimens for May 20 and four for June 1. In the Pine Barrens between Medford and Indian Mills, thirteen *lentus* were found in deer droppings on June 11 and 14. As the name implies, this seems to be a spring species. It is a sluggish insect and further resembles *stupidus* in having an inconspicuous vesture of fine pubescence. It is, however, usually smaller, brighter brown and lacks the frontal tubercles of the foregoing species.

Aphodius campestris Blatch. Superficially similar to *stercorosus* Melsh. and no doubt confused with it in previous records. *Campestris* differs in possessing the following characters: The pronotum distinctly margined posteriorly, the elytra sparsely pubescent near external margin towards apex, the first hind tarsal joint less elongate. It seems to be a spring and early summer species, common in the sandy Pine Barrens. For a definite record Rancocas Park, May 20, 1929, is given.

Aphodius serval Say. This small species somewhat resembles *distinctus* (Mull.) but is usually smaller and has two minute denticles on the clypeus. The first New Jersey specimen was brought in by R. W. Burrell on November 14, 1927, and was collected near Riverton. In 1928, the writer collected three near Riverton as they were flying late in the afternoon of March 25. On March 13, 1929, several more were found under rubbish on the ground in the same locality. None has been found under excrement of any sort, so the feeding habits are not definitely known. It is possible that *serval* normally inhabits the runways of field mice or other small mammals.

Aphodius prodromus (Brahm). This abundant European species, which often fairly swarms in our pastures, so closely resembles *femoralis* Say that it was probably overlooked by the older collectors, or maybe it has only recently become numerous here. *Femoralis* has a nearly uniform dirty-yellowish elytral disk, each elytral interval has a row of close, fairly large punctures near each margin, and the fine punctation of the pronotal disk is quite distinct; while in *prodromus* the elytral disk has a large light wedge-shaped area extending back medially from the base, the rows of punctures on the intervals are much less distinct, and the finer punctures of the pronotum are nearly obsolete. For *prodromus* the following records are offered: Watchung Mountains, September 9, 1925; Riverton, October 16, 1925; Bordentown, May 13, 1926.

Dialytes striatulus (Say). About fifty individuals of this interesting little beetle were collected on June 11, 14, 16 and 18, 1929, at Jericho, New Jersey. They were all found under horse droppings in a damp shaded depression of the old stage road. The elevation at this point is about seventy feet. Many other likely places in the neighborhood were carefully gone over but no further specimens were discovered. Otherwise, I have taken this species only on the mountains of Pennsylvania and Maryland. It might be mentioned here that *D. truncatus* (Melsh.) has been found to be abundant on the mountains aforesaid and has been recorded for the region of Lake Hopatcong, New Jersey, but on July 15 and 20, 1929, more than 100 examples were discovered in deer excrement in the Pine Barrens. These were in

the locality mentioned for *Aphodius lentus*, between Medford and Indian Mills. The elevation at that point is given as 100 feet.

This closes the discussion of the coprophagous scarabæids added to our list.

Now we turn to those little-known beetles which I believe to be fungus feeders. The only reference to this that I have found is in *Social Life in The Insect World*, by that observant French naturalist, J. H. Fabre. In this book is a chapter headed "The Truffle-hunter (*Bolboceras gallicus*)" = *Bolbelasmus gallicum* (Muls.). This beetle, related to our *Bolboceras*, he found feeding upon *Hydnocystis arenaria*, a subterranean fungus resembling the truffle. Several years' digging of the subterranean tunnels of species of *Bolboceras*, *Bolbocerosoma*, *Eucanthus* and *Odontæus* failed to throw any light upon the feeding habits of these mysterious insects. Then on October 11, 1928, when excavating the burrow of an *Odontæus* in Rancocas Park, I came upon a beetle an inch or two beneath the surface, associated with a small greenish-gray mass of jelly-like substance. Further digging in the same locality within a day or so yielded similar results, but in one case the gelatinous mass was enveloped in a tough skin similar to that of a puff-ball (*Lycoperdon*, for instance). All this material, including the beetles themselves, was taken to the laboratory where Mr. M. C. Swingle made microscope slides of the fungus substance and the insects' stomach contents. In each case there were elliptical greenish spores scattered through a matrix of colorless jelly. The slides, together with an alcoholic specimen of a complete fungus, were sent to Minnie M. Johnson, of Ohio, who identified the mycological material as a peculiar subterranean fungus named *Rhizopogon pachyphloes* Z. & D. The beetles from this station were subsequently submitted to J. B. Wallis, of Winnipeg, and were described by him under the name of—

Odontæus darlingtoni. My first specimens of this were taken at Rancocas Park (the type locality) on October 25, 1926. Since then they have been found regularly burrowing in the sand under the pines of that place from October to March. Just to see if the above described experience could be duplicated, I

visited the location on January 8, 1930, and unearthed two males and two females in individual burrows, and one of the beetles was found to have collected a mass of *Rhizopogon* jelly. Thus, it will be seen that *darlingtoni* is our winter *Odontæus*, just as *blackburni* is our winter representative of *Geotrupes*.

Odontæus simi Wallis. The type locality for the present species is the golf course at Merchantville, New Jersey. This seems to be a characteristic habitat. Throughout July and August the little beetles give evidence of their presence on green and fairway by pushing up small but conspicuous piles of sand. This and three other beetles of the same general group are considered pests by greenskeepers on account of their habit of thus marring the appearance of the golf courses with their little sand piles. *Simi* has been found, also, associated with *darlingtoni* at Rancocas Park, in a pine-oak bush-lot near Riverside and associated with *liebecki* on Arney's Mount.

Odontæus liebecki Wallis. This species is more distinctly characteristic of higher elevations. Unlike the preceding beetle which frequently works in open sunny places, *liebecki* is most likely to be found burrowing on the upper levels of well-shaded hills and mountains. While the beetles, of course, frequently have their homes under the leaf carpet of the forest floor, their diggings are much more easily found along some old wood road of which the little used wheel tracks are bare. For New Jersey records I mention the Jenny Jump Mountains, August 17, 1929, and Arney's Mount, August 30, 1927.

Bolbocerosoma tumefactum (Beauv.) is another beetle which has frequently been reported as a pest on golf courses. The work of this is very similar to that of the *Odontæus* and *Eucanthus* in the same localities. In addition to golf courses, it frequents old roadways which are not too well shaded. Most of my specimens were collected in such a spot near Rancocas. Between August 21 and October 3, 1927, seventy-five *tumefactum* were collected there.

Of the six New Jersey species belonging to the present group, *Odontæus darlingtoni* is the only one so far found associated with any food material, but it is believed that all related species and

genera will eventually be found to be feeders upon subterranean fungi.

The following insects are all strictly phytophagous.

Serica carolina Daws. Thus far not frequently met with in New Jersey. My only records are one specimen found in the wash-up at Seaside Park, June 20, 1926, and one taken at night on Hooton Hill, June 13, 1928.

Serica opposita Daws. The first record for this exceedingly abundant species seems to be May 25, 1919, when type material was collected at Riverton by J. J. Davis. At least along the edges of the Pine Barren area, *opposita* is the most common and evenly distributed of all our *Serica*. Its hours of activity begin at dusk and various oaks are the favorite food plants.

Serica lecontei Daws. A locally common species on the higher grounds and in certain parts of the Pine Barren. The localities given by Dawson are Bergen County, Lahaway, Ocean County, Fort Lee District, Ridgewood, Phillipsburg and Browns Mills Junction. No dates are given. Two of my own collecting dates are Arney's Mount, June 26, 1926, and Hooton Hill, June 28, 1928.

Serica georgiana Leng. Taken in some abundance on a wooded hill near Langhorne, Pennsylvania, but apparently less common in New Jersey. I have it recorded only for Arney's Mount, June 22, 1926.

Serica cuculata Daws. Several of this rather large shining blackish-brown species were collected on Hooton Hill on June 9 and June 16, 1928. They were found resting under dead leaves on the ground in the daytime and feeding upon the leaves of oak and chestnut bushes at dusk.

Phyllophaga diffinis (Blanch.). A rather small dark member of the genus and apparently somewhat southern in distribution. In 1926, thirty-three specimens were collected at Rancocas Park between May 13 and June 13. In 1927, sixteen were collected in the same locality between May 13 and June 8. Some were taken from under the leaf carpet during the daytime and others were collected at night feeding upon the foliage of black jack and black oak and persimmon. While usually somewhat smaller,

diffinis bears a general resemblance to *forsteri* Burm., but the male has a much longer antennal club.

Phyllophaga subtonsa (Lec.). Of this large fine pubescent species, I have two old Anglesea specimens collected by H. W. and H. A. Wenzel. One is marked July 3 and the other July 7, but no year is given. My first date records one specimen taken near Riverton on May 14, 1924. Most of the New Jersey material has been collected near the top of Arney's Mount. In May and June 2, 1926 to 1928, ten specimens were collected there by scratching away the dead leaves on the ground. The locality has not been visited at night, but since oak species are prevalent on this wooded hill, probably they form the favorite food plants of *subtonsa*.

Anomala nigropicta Csy. Usually our most common *Anomala*. It may be found in numbers lying beneath the dead leaves in woodlands during the daytime and at night is very active, sometimes swarming among the foliage of maples, or feeding in rose blossoms. It is present throughout spring and early summer. For definite dates we give Rancocas Park, May 11, 1927, and Riverton, July 12, 1927. During July each year, it has been found feeding in large numbers after dark upon the flowers of the Japanese chestnut.

DESCRIPTIONS OF NEW SOUTH AMERICAN HESPERIIDÆ, (LEPIDOPTERA, RHOPALOCERA)

BY E. L. BELL

FLUSHING, N. Y.

Onophas watsoni new species. (Fig. I, male genitalia; paratype.)

MALE. Upperside. Primaries, reddish-brown; a discal band of the following rather ill-defined, yellowish spots: two small ones in interspace 1, a larger one in interspace 2, excised on its outer margin, a smaller one in interspace 3; hazy indications of a spot in interspaces 4 and 5, and hazy subapical spots in interspaces 6 and 7. Basal half of the costal margin a little paler than the apical half. Secondaries, same color as the primaries, a little paler in the center of the disc, with long brown hairs from the base of the wing over the disc and along the inner edge of the abdominal fold with a few greenish hairs at its base. Fringes of both wings a little paler than the ground color of the wing.

Beneath. Primaries, spots of the upper side repeated, paler in color; those of interspace 1 fused into one spot, in interspaces 2 and 3 somewhat better defined, those in 4, 5, 6 and 7 hazier than above; costal margin yellow as far as the sub-apical spots; apex and outer margin purple as far as vein 2, the rest of the wing brownish. Secondaries, basal two-thirds yellowish; the entire outer margin from the outer angle to the anal angle broadly purple. Fringes of both wings fuscous.

Thorax, above metallic greenish, beneath, bluish-gray; abdomen, brown above, beneath whitish. Legs, brown above, bluish beneath, with long blue-gray hairs on the thighs, mid tibiæ spined. Head metallic green. Palpi green above, beneath, black interspersed with bluish-gray hairs.

Antennæ, above black, beneath with a pale spot at each joint, basal two-thirds of the club yellowish, and a narrow yellow line on the apiculus.

Expanse. Male, 36 mm.

Stigma similar to that of *Onophas columbaria* Herrich-Schaffer, but somewhat heavier and continued almost to vein 1 in two parts.

The form of the genitalia is very similar to that of *columbaria*.

Described from two males from Annaburg, Santa Catharina, Brazil.

Type, male, in the collection of the American Museum of Natural History, New York City; one male paratype in collection of the author.

This handsome species is named for my good friend Mr. F. E. Watson. The paratype is somewhat worn, and the purple areas

on the underside of the wings of the type are brown in the paratype.

Onophas distigma new species. (Fig. 2, male genitalia; type.)

MALE. Upperside. Primaries, brown, with discal spots as follows: a scarcely perceptible indication of a spot in interspace 1, in interspace 2 an ill-defined spot, yellowish with brown scales intermixed, a smaller and similarly colored spot in interspace 3; a minute, hazy sub-apical spot in interspace 6. Costal margin towards the end of the cell with fulvous scales; at the base of the wing with sparse metallic blue scales. Secondaries, same color as primaries, with long brown hairs in the disc and along the inner edge of the abdominal fold with a few bluish hairs intermixed at the base. Fringes of both wings concolorous, a little lighter at the tips.

Beneath. Primaries, the spot in interspace 1 plainly visible, whitish, the spots in interspaces 2 and 3 paler than above, the subapical spot not repeated; costal margin yellow from the base to beyond the end of the cell, apex and outer margin, as far as vein 2, brown, oversealed with yellow; the rest of the wing black, slightly paler at the anal angle. Secondaries, the basal third yellowish, gradually shading to brown at the margin. Fringes fuscous, paler at the tips, intermixed with yellowish especially so on the secondaries.

Thorax, above metallic bluish and greenish, beneath blue-gray.

Abdomen, above at the base, metallic greenish-blue, the rest brownish, beneath, whitish with a dark line through the center, bluish-gray at the base. Legs, brown above, bluish-gray beneath, thighs with bluish-gray hairs, mid tibiae spined.

Head and palpi above metallic blue-green, palpi beneath blue with some black hairs intermixed. Antennae, black above and beneath, the club beneath yellow, including the apiculus.

The male has no stigma. The form of the genitalia is very similar to that of both *columbaria* and *watsoni*.

Female similar to the male.

Expanse. Male, 34 mm.; female, 36 mm.

Described from one male and two females from Annaburg, Santa Catharina, Brazil.

Type, male, and allotype, female in collection of the author; one female paratype in the collection of the American Museum of Natural History, New York City.

Eutocus schmithi new species. (Fig. 3, male genitalia; paratype.)

MALE. Upperside. Primaries, and secondaries, blackish-brown. Fringes fuscous and lighter scales intermixed, paler at the tips, somewhat paler on the secondaries.

Beneath. Primaries, costal margin reddish; outer margin from apex to vein 3, lilac, which extends inwardly as spots between veins 4 and 7, two

antemarginal rows of dark spots, and a reddish-brown marginal line, the rest of the wing is black, somewhat paler at the inner margin; a lilac sub-apical spot between veins 8 and 9. Secondaries, reddish-brown, abdominal fold brown, inner margin narrowly reddish-brown sprinkled with lilac; a band of lilac scales extends across the wing from near the center of the costal margin, around the cell-end to near the base of the abdominal fold, another broad lilac band extends from the outer angle to the abdominal fold and includes all of the lower part of the wing, and is cut into by one or two fine lines of the ground color running outwardly from the abdominal fold, just above the anal angle; a sub-marginal row of dark spots, and a reddish marginal line along the outer border. Fringes, of both wings darker than above, paler at the tips and still paler at the anal angle of the secondaries.

Thorax, above brownish with some paler scales at the sides near the wing base; shoulder covers with brown and reddish hairs intermixed, beneath, fuscous. Abdomen, above brown, beneath, pale reddish-brown. Legs, brown with reddish-brown hairs. Head reddish-brown. Palpi, reddish and black intermixed. Antennæ, black above, beneath yellowish.

A triangular stigma fills the base of interspace 2.

Female similar to the male but both the female and the male paratype have a second sub-apical spot on the primaries beneath, between veins 7 and 8, and a faint indication of sub-apical spots on the upper side.

Expanse: Male and female, 30 mm.

Described from one male from Hansa Humboldt, one male from Blumenau, one female from Annaburg, all in Santa Catharina, Brazil.

Type, male, Hansa Humboldt, allotype, female, Annaburg, in collection of the American Museum of Natural History, New York City; paratype, male, Blumenau, in collection of the author.

This species is superficially very similar to *Megistias* (?) *ranesus* Schaus, which has a stigma of similar form; *schmithi* is somewhat larger than *ranesus* and lacks the red spot at the base of the secondaries beneath; the genitalia are also different, as may be seen by comparing figures 3 and 4.

Named for Mr. Karl Schmith, of Hansa Humboldt, Brazil.

Eutychide maculata new species. (Fig. 5, male genitalia; type.)

MALE. Upperside. Forewings, red-brown, with seven small spots as follows: three in a transverse discal row, the lowest on vein 1, semi-hyaline, one between veins 2 and 3, one between veins 3 and 4, two in the cell, the upper one obliquely over the lower, two sub-apical spots; all of the last six

spots mentioned are white hyaline. Fringes paler. Secondaries, same color as primaries, immaculate. Fringes paler.

Beneath. Primaries, red-brown, paler at the costal margin and apex; spots of the upper side repeated, the one on vein 1 being elongated to the outer margin as a diffused whitish patch. Secondaries, red-brown, with a slightly paler, narrow marginal area. Four small yellow spots in a curved discal row and one in the cell-end.

Body, above red-brown, beneath on the abdomen yellowish. Legs paler brown. Head and palpi, above brown mixed with yellow; palpi, beneath yellow. The antennæ are unfortunately lost in this specimen.

Expanse: 32 mm.

Described from one male from Santa Cruz, Bolivia, which is designated as the type and is in the collection of the author.

The stigma is of the usual form of *Eutychide* but the parts are narrow, not so greatly developed as in some of the species in this genus.

Eutychide hyalinus new species. (Fig. 6, male genitalia; type.)

MALE. Upperside. Primaries, brown with four white-hyaline spots as follows: a small spot on vein 1, a large quadrate spot between veins 2 and 3, a smaller subquadrate spot between veins 3 and 4, a sub-apical spot between veins 6 and 7. Fringes concolorous. Secondaries, same color as primaries, a hazy indication of a paler discal spot. Fringes concolorous, a little paler at the tips.

Beneath. Primaries, costal margin, apex and outer margin as far as vein 2 purplish; rest of the wing black, spots of the upper side repeated, that in interspace 1 is enlarged by whitish scaling. Secondaries, purplish, the veins brownish; hazy indication of a pale discal patch.

Thorax, above dark brown and greenish; abdomen brown above, beneath whitish. Legs brown. Head and palpi, above brown and greenish, mixed; palpi, beneath fuscous mixed with whitish. Antennæ, above black, beneath narrowly yellowish, including nearly all of the club, apiculus reddish.

Expanse: 32 mm.

The stigma is of the form found in this genus, but the parts are rather narrow.

Described from one male from Hansa Humboldt, Santa Catharina, Brazil, which is designated as the type and is in the collection of the author.

The form of the genitalia of *hyalinus* is similar to that of *orthos* Godman, but superficially the two are quite different.

Thoon viridis new species. (Fig. 7, male genitalia; type.)

MALE. Upperside. Primaries, and secondaries, immaculate dark brown. Fringes concolorous, slightly paler at the tips.

Beneath. Primaries, costal margin, apical area and outer margin as far as vein 2, olive-greenish, the rest of the wing dull blackish; a barely perceptible paler streak above vein 1; a minute whitish sub-apical spot between veins 6 and 7. Secondaries, olive-greenish, three whitish spots, one each between veins 3-4, 4-5, 5-6, and another in the cell.

Thorax, above, greenish; abdomen, black, with a few reddish hairs at the sides; thorax, beneath fuscous with a greenish tinge; abdomen paler. Legs brown. Head and palpi, above, greenish; palpi, beneath, fuscous and yellowish mixed, with a greenish reflection at the base. Antennæ, above and beneath, black, the club, yellowish in the basal two-thirds with a few brown spots.

Expanse: male, 38 mm.

The stigma is two small spots, one above and one beneath vein 2, near its base.

Described from one male from Cochabamba, Bolivia, which is designated the type and is in the collection of the author.

Cobalus huntingtoni new species. (Fig. 8, male genitalia; paratype.)

MALE. Upperside. Primaries, dark brown, with six whitish hyaline spots as follows: a subquadrate spot between veins 2 and 3, a smaller one between veins 3 and 4, two spots in the cell, one directly above the other, and just above the spot in interspace 2 (in the paratype the cellular spots are fused into one spot constricted in the middle), two minute sub-apical spots. At the base of the wings with some greenish hairs. Secondaries, same color as the primaries, with two whitish hyaline spots beyond the cell-end. Fringes concolorous, paler at the anal angle of the secondaries, a few greenish hairs at the base.

Beneath. Primaries, costal margin, apical area and outer margin as far as vein 2, dark red, some yellow scales in the cell just inside the cellular spots; disc of the wing, black, paler at the inner margin; spots of the upper side repeated; a very hazy indication of a third sub-apical spot above the other two: a large pale yellow spot in interspace 1 under the discal band. Secondaries, dark red, spots of the upper side repeated. Fringes as above.

Body. Thorax above, dark green and blue; abdomen, dark brown; beneath, thorax with greenish and fuscous hairs mixed; abdomen reddish with paler scales at the joints. Legs, above brown with some reddish scales, beneath yellowish or pale brownish. Head and palpi, above green, palpi, beneath reddish brown, paler at the base; pectus reddish brown and green. Antennæ, black above and beneath, except the club beneath is yellow.

No stigma.

Expanse: male, 44 mm.

Described from two males from Annaburg, Santa Catharina, Brazil.

Type, male, in collection of the American Museum of Natural History, New York City. Paratype, male in the collection of the author.

Named for my good friend Mr. E. Irving Huntington.

This species is very similar to *Cobalus fortis* Schaus, but differs in the shape of the hyaline spots of the primaries, in having but two sub-apical spots against three in *fortis*, in the much darker ground color of the wings beneath, and in the lack of the yellow overscaling of the underside of the wings.

Cobalus boliviensis new species. (Fig. 9, male genitalia; paratype.)

MALE. Upperside. Primaries, brown, heavily overscaled with yellow in the discal and basal area, sparsely so almost to the outer margin, some greenish-yellow hairs along the inner margin; five spots as follows: an accumulation of yellow scales about the center of vein 1, not forming a well defined spot (this spot is more prominent in the type than in any of the others, entirely absent in one), a yellow subhyaline spot between veins 2 and 3, excised on its outer side, a smaller and similar spot between veins 3 and 4, two yellow subhyaline sub-apical spots between veins 6-7 and 7-8. Fringes concolorous. Secondaries, same color as primaries, with greenish-yellow hairs from the base over the disc and along the abdominal fold's inner margin; two yellowish sub-hyaline spots beyond the cell-end. Fringes concolorous.

Beneath. Primaries, ferruginous, a black spot at the extreme base below the cell, the discal area a little darkened, a yellow streak through the upper part of the cell, spots of the upper side repeated, that in interspace 1 very large and yellow. Secondaries, ferruginous, with scattered yellow overscaling, spots of the upperside repeated. Fringes fuscous with ferruginous scales at the base.

Body; thorax, above yellowish-green; abdomen, with yellowish-green hairs at the base, the rest ferruginous; beneath, thorax with yellowish-green hairs; abdomen pale yellowish. Legs brown, striped yellowish beneath. Head and palpi above yellowish-green, palpi beneath, yellow, with scattered scales black tipped; pectus yellowish. Antennæ, above black, beneath narrowly yellowish, the basal three-quarters of the club bright yellow and apiculus red.

No stigma.

Expanse: 42 mm.

Described from four males from Santa Cruz, Bolivia.

Type, male, in collection of the American Museum of Natural History, New York City; three male paratypes in the collection of the author.

Moeris mapirica new species. (Fig. 10, male genitalia; type.)

MALE. Upperside. Primaries, reddish-brown, indistinct discal spots between veins 2 and 3, 3 and 4, and three indistinct sub-apical spots; the cellular area darker than the rest of the wing. Secondaries, same color as the primaries. Fringes, slightly paler than the ground color of the wings.

Beneath. Primaries, purplish, a darker purple patch beyond the cell-end; below vein 2 pale brownish to the inner margin; ill-defined lilac spots in the interspaces between veins 2 to 8, forming a curved row from below the cell-end around the dark purple patch; a diffused light brown area at the anal angle; veins pale brown, contrasting in the purple area to the apex. Secondaries, purple, the costal margin very dark purple, and a broad discal band of the same color from the outer angle to the inner margin; basal and marginal third of the wing paler; hazy indications of lilacine spots bordering the dark discal band on its outer edge.

Body; thorax above greenish, abdomen brown; beneath, thorax and abdomen whitish. Legs yellowish-brown. Head and palpi, above fuscous mixed with yellowish; palpi beneath white, towards the tip mixed with yellowish and black. Antennæ, above black; beneath, basal half black, upper half including the club, yellow. Stigma not as well developed as in *striga* Hubner, the part between veins 1 and 2 being very small, the lowest spot hardly visible.

Expanse: male, 32 mm.

Described from one male from Mapiri, Bolivia; which is designated as the type and is in the collection of the author.

Augiades gloriosa new species. (Fig. II, male genitalia; type.)

Male. Upperside. Primaries, apex and outer margin broadly black, a discal band of four spots from the inner margin to the cell-end, two small extra-discal spots and three sub-apical spots, all fulvous; costal margin fulvous, a fulvous spot in interspace 1 from the stigma to the base; a black spot between the extra-discal spots and the cell-end, which is extended as a heavy black line along the apical third of the cell on its costal edge and terminates as a small spot just within the cell; median vein heavily black from the stigma to the base of the wing; all of the veins black. Secondaries, costa, outer margin, and anal angle broadly black, basal third black with a fulvous spot in the cell; a broad, curved, fulvous discal band, crossed by the black veins. Fringes fulvous at the anal angle of the primaries, becoming fuscous at the apex; of the secondaries, fulvous.

Beneath. Primaries, costa, apex, and outer margin grayish-yellow, cell fulvous, spots in interspaces 2 and 3 fulvous, that in interspace 1 yellow, all three bordered externally with black, a black stripe across the cell-end, below the cell black to the discal spots. Secondaries, grayish-yellow, the discal band and cellular spot repeated, another spot at the costal margin above the cellular spot, all pale yellow. Fringes as above but paler.

Body. Thorax, above greenish with yellow hairs at end of shoulder covers; abdomen black with fulvous hairs, yellow on the sides; beneath, thorax yellow; abdomen white; anal extremity fulvous. Legs fulvous. Head, above greenish-yellow; palpi above and beneath yellow; pectus, yellow. Antennæ, above black; beneath, orange; apiculus, reddish.

Female. Upperside. Primaries, dark brown with a purplish tinge towards the base, paler at the costal margin almost to the cell-end; some greenish hairs above and below vein 1 towards the base; eight semi-hyaline, white spots as follows: three in a transverse discal band, that in interspace 2 is the largest, a minute dot about the center of interspace 4, three sub-apical, of which the upper is the smaller, a spot in the cell obliquely above that in interspace 2. Secondaries, same color as the primaries, a discal row of five yellow spots, and hazy indications of two more spots between the lowest yellow spot and the inner margin, a small yellow spot in the cell; some greenish hairing in the basal part of the cell and along the inner margin of the abdominal fold.

Beneath. Primaries, costal margin and apical area to vein 1, pale brownish, rest of the wing purple-black, paler at the inner margin; spots of the upper side repeated, the one in interspace 1 enlarged and extended toward the outer margin, diffused outwardly. Secondaries, pale brown, spots of upper side repeated, pale yellow and overscaled with the ground color, the lowest of the two hazy spots of the upper side is repeated as a distinct spot, the other absent; veins slightly paler in the outer half.

Body. Thorax, above with some brown hairs at the end; abdomen, brown with yellow hairs on the sides; beneath, thorax yellowish; abdomen white. Legs pale brown. Head and palpi, above greenish and yellow; palpi beneath and pectus, yellow. Antennæ as in the male.

Expanse: male, 41 mm.; female, 44 mm.

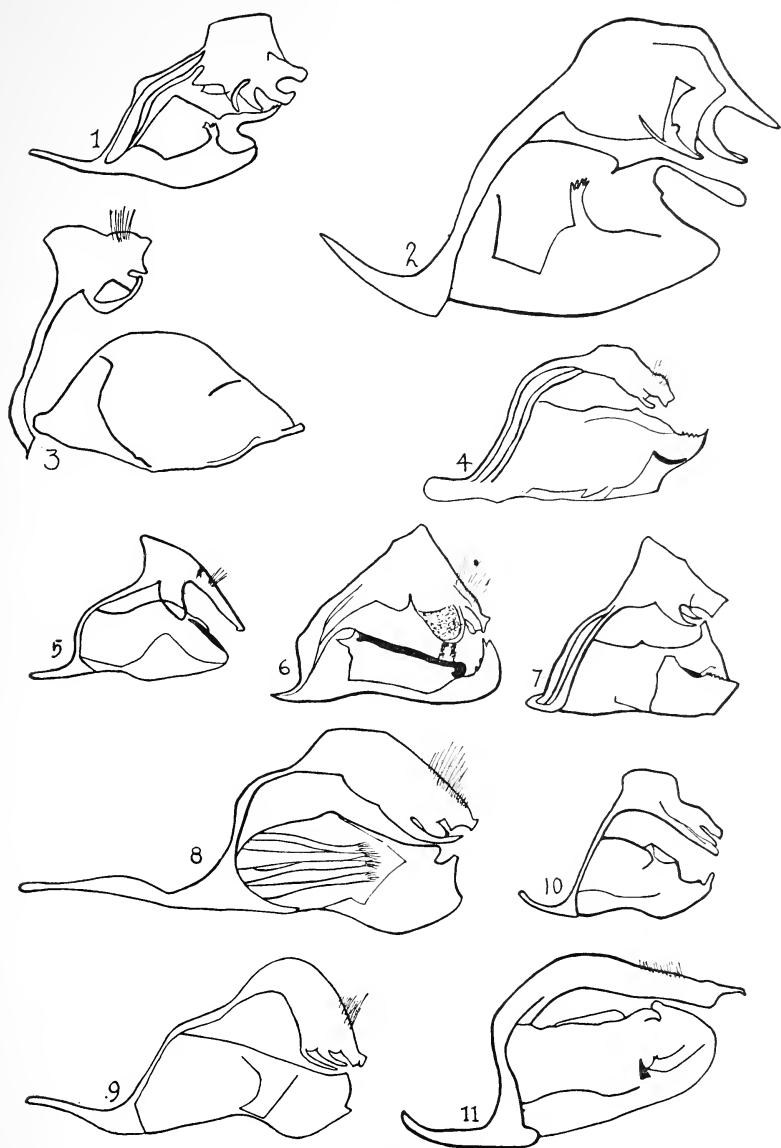
Described from one male and two females from Hansa Humboldt, Santa Catharina, Brazil.

Type, male, and allotype, female, in the collection of the author; paratype, female, in the collection of the American Museum of Natural History, New York City.

All measurements of wing expanse are from center of the thorax to the apex $\times 2$.

PLATE IX

- Figure 1. *Onophas watsoni* (paratype).
Figure 2. *Onophas distigma* (type).
Figure 3. *Eutochus schmithi* (paratype).
Figure 4. *Megistias ranesus* Schaus.
Figure 5. *Eutychide maculata* (type).
Figure 6. *Eutychide hyalinus* (type).
Figure 7. *Thoon viridis* (type).
Figure 8. *Cobalus huntingtoni* (paratype).
Figure 9. *Cobalus boliviensis* (paratype).
Figure 10. *Moeris mapirica* (type).
Figure 11. *Augiades gloriosa* (type).



HESPERIIDÆ

BEE-KILLING ROBBER FLIES

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ABSTRACT

Certain robber flies frequently feed on honey bees and have been known as "bee-killers." In North America, *Promachus fitchii* O. S. and in the Argentine, *Mallophora ruficauda* Wied. have been recorded as causing losses to bee-keepers. In the United States five genera, *Stenopogon*, *Deromyia*, *Promachus*, *Mallophora* and *Proctacanthus*, contain species which commonly kill bees, while two genera, *Bombomima* and *Erax*, contain species which occasionally do so. A control measure is suggested in the rare cases where economic losses are caused.

That so defenseless an insect as a fly should be able to overcome and devour so formidably defended an insect as a bee is a matter of considerable interest. Yet certain robber flies frequently kill bees and have even caused economic losses to bee-keepers. The present paper will be limited for the most part to those species in which this activity has been noted.

It was in Europe where the bee-feeding habit was first noted, but little economic importance has been attached to the habit there. Robineau-Desvoidy was one of the first to remark upon the killing of bees by robber flies. In 1836, he called attention to the fact that *Selidopogon diadema* Fabricius frequently chose the honey bee for its prey. In more recent years, two writers, Poulton and Sarel-Whitfield, have recorded European species feeding on honey bees.

SPAIN. Poulton (1906) found *Selidopogon diadema* Fabricius feeding extensively on the honey bee. He also took a species of *Machimus* (probably *chrysitis*) and another species near *setibarbis* preying on honey bees.

ENGLAND. Sarel-Whitfield (1925) has recorded *Asilus crabroniformis* Linn. as feeding on the honey bee.

INDIA. Poulton (1906—quoting T. B. Fry, 1902) lists *Laxenecera flavibarbis* Macq. as feeding on the small Indian honey bee (*Apis florea*). Walker gave the name *apivorus* to a species of *Promachus* from Burma because it was reported as feeding on the large black bees.

AFRICA. Poulton (1906—quoting Marshall, 1902) lists a species of *Promachus* near *guineensis* with the African form of the honey bee. In a collection of Asilidæ sent me by Mr. H. K. Munro of Pretoria, South Africa, two species were present with honey bees in their grasp. These were *Promachus vagator* and a large undetermined species of *Neolophonotus*. Dr. von Someren of Nairobi, Kenya Colony, reporting to Professor Poulton (1924) on the habits of *Hyperechia bifasciata* Grünb. and *H. imitator* Grünb. mentioned that he has noted them feeding on *Apis mellifera adansonii*.

ARGENTINA. *Mallophora ruficauda* Wied. abounds in the plantations about Buenos Aires and is recorded by Copello (1922 and 1927) as a particular enemy of the honey bee.

CUBA. *Mallophora maquartii* Rondani is abundant in Cuba and feeds largely on honey bees where these are available (Bromley—quoting Bruner, 1929).

NORTH AMERICA. The first writer to report the bee-killing habits of these flies in North America was Dr. Asa Fitch, who in 1864 described the “Nebraska bee-killer,” *Trupanea apivora*, now known as *Promachus fitchii* O. S. The specimens from which Fitch’s descriptions were made were received from R. O. Thompson, Esq., Florist and Nurserymen, Nursery Hill, Otoe County, Neb., together with a note dated June 28, 1864, stating that the insects were destructive to honey bees and rose bugs. A later communication from Mr. Thompson gave further information on the habits of the fly.

“My attention was first called to this fly destroying the honey bee by a little boy, a son of D. C. Utty, Esq., of this place. After sending you the specimens I watched its proceedings and habits with much care, and find that, in addition to the honeybee and rose bugs, it devours many other kinds of beetles, bugs and flies, some of which are as large again as itself. It appears to be in the months of June and July that it is abroad upon the wing, destroying the bees. None of them are now (August 2d) to be seen. When in pursuit of its prey it makes quite rapid dashes, always capturing the bee on the wing. When once secured by wrapping its legs about it, pressing it tightly to its own body, it immediately seeks a bush or tall weed, upon which it alights and

commences devouring its prey by eating (piercing) a hole into the body and in a short time entirely consuming it (sucking out the fluids and soft internal viscera) and leaving only the hard outer skin or shell of the bee. Upon the ground beneath some favorable perch for the fly near the apiary, hundreds of these shells of bees are found accumulated in a single day—whether the work of one fly or of several I am not able to say. I have just returned from a professional tour through the northern portion of our territory, taking Nursery orders; and in many things this business and the apiary are closely connected. In no case have I found a hive of bees that has thrown off a swarm this season! The dry weather, a bad pasture and other reasons were assigned as the cause. But many persons, since they have found this fly at his work of destruction, now believe it to be the cause of the non-swarving of their bees; and I am led to the same opinion. I have only to add further, that this bee-killer delights in hot, dry weather, and is very invulnerable and tenacious of life.” A good illustration of the insect is given in Fitch’s report and the description leaves no doubt as to its identity.

This fly was also mentioned by C. V. Riley in his first Annual Report on the Noxious, Beneficial and Other Insects of Missouri, page 168 (1869). Dr. Fitch’s correspondent, Mr. Thompson, had moved to Missouri where he met Riley and informed him that he had found the fly in increasing numbers every year since 1864 when his report to Fitch had been made. In 1868, he reported that it had made its appearance in such numbers in Northern Missouri as to prevent to a great extent bees from swarming. In the Rural World, September 12, 1868, he stated that he had watched one individual and found that it destroyed no less than 141 bees in a single day.

In his second Annual Report, page 121, 1870, Riley again refers to this fly, stating that it was the same as *Promachus bastardi*, an error which persisted to the extent that in most of the subsequent references to the Nebraska bee-killer the name *Promachus bastardi* has been used. Riley described in this report another robber fly taken with honey bees, giving it the name *Asilus missouriensis* or the Missouri bee-killer. This species was subsequently identified as *Proctacanthus milbertii* Macquart.

Riley stated that this species "acts in the same manner as the Nebraska Bee-killer, being, if anything, more inhuman and savage."

In the Bee-Keepers' Guide (1894—Fifteenth Edition—page 414) Professor A. J. Cook gives robber flies prominence as enemies of bees. He mentions *Asilus missouriensis* Riley (= *Proctacanthus milbertii* Macquart) but also notes that in Michigan "this species has been observed to kill the cabbage butterfly by scores." He next mentions an *Erax* from Louisiana (*Erax interruptus* Macquart, I judge by the figure) and the "Nebraska bee-killer" (for which he erroneously used the name *Promachus bastardi* Macquart).

A more detailed description of the so-called "Southern bee-killers" (*Mallophora orcina* Wiedemann and *M. bomboides* Wiedemann) was then given. The most common was noted as *M. orcina* occurring in Tennessee, Georgia and Florida. Cook states that "the habits of the flies are interesting, if not to our liking. Their flight is like the wind, and perched near the hive, they rush upon the unwary bee returning to the hive with its full load of nectar, and grasping it with their hard strong legs, they bear it to some perch nearby, when they pierce the crust, suck out the juices, and drop the carcass, and are then ready to repeat the operation. A hole in the bee shows the cause of its sudden taking off. The eviscerated bee is not always killed at once by this rude onslaught, but often can crawl some distance away from where it falls, before it expires." The latter observation I have never been able to verify. In all cases, that I have observed, the victim is killed almost immediately at the initial piercing of the fly's beak. In addition, Cook mentions "the *Laphria thoracica* of Fabricius" (*Bombomima thoracica* Fabricius) as occurring in Georgia and having the same bee-killing habits.

THE BEE-KILLING GENERA OF THE U. S.

In this country, the bee-killing species occur principally in seven genera, namely, *Stenopogon*, *Deromyia*, *Bombomima* (*Dasyllis*), *Promachus*, *Mallophora*, *Proctacanthus* and, occasionally, *Erax*. We shall consider the species involved under their separate subfamilies.

Leptogastrinæ

No member of this subfamily is known to kill honey bees.

Dasypogoninæ

Bee-killing species of this subfamily in the United States occur in the genera *Stenopogon* and *Deromyia*, although it is quite probable that the larger species of *Saropogon* such as *S. combustus* Loew and *S. dispar* Coquillett may also kill honey bees. The two species of *Microstylus* to which belong our largest Asilids occur from Mexico to Kansas but are rare, and little is known of their feeding habits. Those taken with prey had killed large grasshoppers.

Stenopogon. Two species of this genus, *S. obscuriventris* Loew. and a closely related, apparently new, species are very abundant in Southern California. Both species were either observed or taken with prey on many occasions by the writer and the majority of the species captured were worker honey bees. Another apparently new species, related to both the above mentioned, but distinct from either, was found preying on honey bees in Central California.

Deromyia. Probably most of the larger species of this genus will kill honey bees. The habit has been definitely observed in the following species—*umbrina*, *discolor*, *angustipennis* and *symmacha*.

D. rufescens and a new species, common in the southeast, hitherto known as *D. bilineata* Loew, have been taken with worker bumble bees, and both of these species no doubt feed on honey bees when occasion offers.

The species of this genus are rather slender, bare, fragile-appearing robber flies with long and slender but strong legs. When seizing a bee or other large prey, they hold it off at "arm's length" rather than press it tightly to their own bodies as do the species of *Promachus* and *Mallophora*. Flying to a weed or low bush, the *Deromyia* suspends itself from one of the front legs while with the others it manoeuvres its prey into a position favorable for inserting its beak. Less protected by bristles and coarse hairs than the two bee-killing genera above mentioned, *Deromyia*

probably employs this method for protection against the stings of its aculeate victims.

Deromyia umbrina Loew. This common red robber fly of the Northeastern States occurs from mid-July until October along country roadsides, and around the edges of fields and meadows where goldenrod, asters, joe-pye weed and wild carrot are blooming in profusion. It flies with a loud, rather high-pitched hum and feeds largely on honey bees, bumble bees, yellow jackets (*Vespa communis*, *diabolica* and *vidua*) and other *Hymenoptera*. It also preys on other Diptera, particularly *Eristalis*, tachinids and other flies occurring about flowers. Occasionally, I have taken it with a flower beetle or a tree hopper and rarely with a small damsel fly (*Ischnura verticalis*). I have never seen it capture or attempt to capture a butterfly or a grasshopper. In Massachusetts where most of my observations on this species were made, I believe that it kills more honey bees than any other Asilid there. This is due to the fact that it practically limits itself to a Hymenopterous diet, is abundant, generally distributed and occurs where bees are most likely to be found, namely, around flowers.

The overcoming of a mud-dauber wasp (*Sceliphron cementarium*) or a brown wasp (*Polistes pallipes*) appears to be about the limit of its powers so far as Hymenoptera are concerned. The larger and more powerful wasps, such as the white-faced hornet, are too strong for it. In fact, I once saw a white-faced hornet attack and overcome one of this species.

Deromyia discolor Loew. This pale, inconspicuous species occurs throughout the Central States, assuming much the same position as a bee-killer in this region as *D. umbrina* occupies in New England. It occurs in fields and around the edges of woods in somewhat the same habitats as those occupied by *D. umbrina* further north. It is, however, lighter-colored, less robust and flies with a rather weak, drifting flight accompanied by a low dull buzz. Its appearance in the field suggests that of a Hymenopterous insect, such as a *polistes* or large ichneumonid. It is an avid feeder on honey bees and yellow-jacket workers. All feeding records I have for it are Hymenoptera with the exception of one, where the victim was an Asilid fly of the same genus, *D.*

misellus Loew. (hitherto known as *winthemi* Wied., a South American species quite distinct from *misellus*). Marlatt, years ago (1893), called attention to *discolor* feeding on yellow-jackets (*Vespa communis* and *V. carolina*) in Maryland. Later, Banks (1913) recorded it under the name of *D. ternata* as feeding on *Vespa* and also honey bees; while McAtee and Banks (1920, page 20) listed it as feeding on several species of Hymenoptera, including the honey bee and yellow-jackets.

D. angustipennis Loew. This species, quite closely related to the following but distinguished from it by its smaller average size, comparatively more robust appearance, darker wings and darker thoracic markings, appears to be quite common in certain parts of Kansas, where it has been found preying on the honey bee.

D. symmacha Loew. A light-colored species common in Kansas and Texas. It is quite variable in size and large individuals have frequently been identified as *D. bigoti* Bellardi. My determination of *bigoti* is a large Mexican species, darker in color and with dark yellowish wings. Bellardi's specimen was from Mexico. *Symmacha* has been taken feeding on honey bees and also large wasps, such as *Polistes*, *Sphex* and *Psammocharids*.

Laphriinae

This sub-family contains one genus in North America known to kill honey bees, *i.e.*, *Bombomima* Enderlein, formerly termed *Dasyllis*. The true *Dasyllis* is a neotropical genus, entirely unlike our North American species which are closely related to *Laphria*. *Dasyllis* is closely related to the old world genus *Hyperechia* (which frequently take as prey large aculeate Hymenoptera) and its nearest allies in North America are *Andrenosoma* and *Pogonosoma*. The larger species of the two last genera in this country are Hymenoptera feeders and probably kill honey bees.

The species of *Bombomima* are more robust and hairy than the average Asilid and many of them quite closely resemble bumblebees. Both *Bombomima* and the asiline genus *Mallophora*, our two bumble-bee-resembling genera, seem to prefer as prey insects of the "buzzing" rather than the "fluttering" type of flight, but

Bombomima prefers Coleoptera, while *Mallophora* is more partial to Hymenoptera. *Bombomima* will, however, occasionally select Hymenoptera for prey and two species, *B. thoracica* Fabricius and *B. grossa* Fabricius, have been implicated in bee-killing.

Bombomima thoracica Fabricius. This bumble-bee-like species is found in early summer throughout eastern United States along the sunny edges of woods or brushy pastures and in the vicinity of logs and stumps in which the immature stages undergo their development. It has been reared from a pine stump and I have noted the adults about elm, maple and birch logs and stumps. I have frequently taken the adults with beetles in their grasp; the rose beetle, *Macrodactylus subspinosus*, and the dung beetle, *Aphodius fimetarius*, most commonly. Although I have never myself taken it with a honey bee, I have two such records; one from near New York City and one from Lancaster, Pa., and I have on at least one occasion noted it with a solitary bee (*Halic-tus*) as prey. Messrs. Champlain and Guyton of Harrisburg, Pa., showed me a specimen in August, 1927, that had recently been sent in by a bee-keeper with the information that it had been caught killing bees. Cook (1894) recorded this species as killing bees in Georgia.

Bombomima grossa Fabricius. This species also bears a resemblance to bumble-bees, but is considerably larger and stronger than the preceding. It occurs from New England to South Carolina and has been recorded from Florida. Its habitats are much the same as those of *thoracica*. It seems to prefer, however, larger stumps and logs, being particularly partial to elm. Its prey averages much larger than that of *thoracica*. Champlain and Knull (1923) recorded it as capturing a large cicada. I have taken it with, among other prey, the carrion beetle, *Silpha americana*, the rove beetle, *Staphylinus vulpinus*, and the bumble-bee, *Bombus vagans*. One specimen in the National Museum bears the label "feeds on honey bees."

Asilinæ

To this sub-family belongs the majority of our more important bee-killers. These include the genera, *Promachus*, *Mallophora*.

Proctacanthus and occasionally *Erax*. I have no records of any of the genus *Asilus* (*sensu latu*) feeding on the honey bee in this country, although in Europea *Asilus crabroniformis* Linn. is reported as so doing. The genus *Erax* contains many rather large and powerful species in the southwest and it would not be at all surprising to discover bee-killing proclivities in other than the three species mentioned in the present writing.

Promachus. Probably all of our species of *Promachus* will prey on the honey bee if opportunity is given. The species known definitely to prey on honey bees are *fitchii*, *bastardi*, *rufipes*, *vertebratus* and *princeps*.

Promachus fitchii O. S. The "Nebraska Bee-killer." This was the first species of bee-killing habits in this country to which attention was called. Its habitat seems to be quite restricted, although its range is wide, including most of the Middle West, New York and New England. It has also been recorded from Florida. I have never found it except in rather dry hay fields and wheat fields, where it alights on stalks of grass or weeds and on timothy, daisy or clover heads in which the females are often seen to oviposit. While other species are found more frequently around the edges of the fields, this seems to prefer the center, but individuals are generally well distributed throughout the field in which they occur. In a favored field, this species is likely to be found in enormous numbers. I have seen localities in Missouri and Massachusetts where one might stand in the center of a field and by a wave of the hat start up the species by the dozen, the high-pitched shrill buzz of the flies taking flight filling the air on all sides. Felt (1912-1916) has shown that the larva of this species is predaceous on that of *Phyllophaga fusca* and possibly other species of white grubs. It is quite probable that their numbers fluctuate with the number of white grubs in a given territory and the prevalence of the adult fly in certain types of fields is no doubt explainable on this basis.

In addition to honey bees, solitary bees (*Halictus*, *Agapostemon*, etc.) are frequently taken as are Diptera, small Coleoptera and Hemiptera, particularly pentatomids and reduviids, such as *Sinea* sps. It seems to prefer insects of the "buzzing" rather

than the "fluttering" type of flight, although it will sometimes kill small grasshoppers.

Promachus bastardi Macquart. The false "Nebraska bee-killer." This is a common and widely distributed species throughout Central, Eastern and Southern United States. It is of about the same size as *fitchii*, but is darker brown in color as well as differing in other and more important characteristics. It was confused by Riley and other writers with *fitchii*. *Bastardi* has the same high-pitched buzz characteristic of the true "Nebraska bee-killer," but differs somewhat in habitat. *Fitchii* is found in the center of fields, while *bastardi* is found more characteristically around the edges of fields, along roadsides, overgrown walls, and fences, and in brushy pastures and similar locations, where it alights on twigs, posts, stones or tall weeds. The type of insects chosen for prey is quite similar to that of *fitchii*.

Promachus rufipes Wiedemann. The "Bee-Panther." This species is quite common in many parts of the South. It is the largest of its genus east of the Mississippi. It occurs in late summer in habitats that are characteristic of *Deromyia umbrina* further north, i.e.—along the moist edges of fields, roads or woods where golden-rod, joe-pye weed, asters and other herbaceous plants bloom in profusion. *Rufipes* is a bee-killer par excellence and in these flowery haunts of bees, it may be found feeding on honey bees, bumble-bees, solitary bees and wasps, varying its diet with syrphid, tachinid or other asilid flies. (*Erax rufibarbis* and *Mallophora clausicella* have been taken from this species.) I have also taken it with the leaf-footed plant bug (*Leptoglossus phyllopus*). In some parts of the South, its bee-killing habits have been noted by apiarists, who have termed it the "bee-panther."

Promachus vertebratus Say. There are specimens of *Promachus vertebratus* Say in the National Museum bearing the label "feeding on honey bees." I found the species abundant in the wheat and hay fields of northern Missouri along with *P. fitchii*, but occurring more commonly along the "draws" and moister parts of the fields. A few were to be found in the center of the fields, also, where *fitchii* occurred in great numbers. I

did not find any preying on honey bees, although *fitchii* was seizing honey bees right and left in the same fields. The prey of *vertebratus* seemed to average larger than that of *fitchii*. I found them in several instances with large stink bugs (*Euschistus* spp.) and very frequently with grasshoppers (*Melanoplus atlantis* and others). In some cases, the grasshoppers were more bulky than the fly itself and in one case the captor was unable to fly with its victim due to its size. Le Conte (1850) described the attacks of this species on cicindelids. Walton (1922) figures it (page 12, figure 16) as an enemy of grasshoppers. Washburn (1905, page 87) states that he has seen this species flying over a wheat field with a good-sized grasshopper in its grasp. Adams (1915) found it feeding on *Euschistus*. Evidently, the species is more of a grasshopper feeder and less of a honey bee feeder than *fitchii*.

Promachus princeps Williston. The only feeding record I have of this species is one from Washington taken with a worker honey bee.

Mallophora. *Mallophora* is undoubtedly an American offshoot of the cosmopolitan genus *Promachus*. The bee-killing habit of the latter genus occurs also in *Mallophora* where it has become even more fixed and specialized. Generally speaking, members of this genus prefer aculeate Hymenoptera for prey, and—even more remarkable—many of the species closely resemble in appearance bumble-bees and other bees, being much more robust than the average Asilid. All of our larger North American species kill honey bees. In Argentina, *M. ruficauda* Wiedemann is a distinct enemy of honey bees (Copello, 1922 and 1927), while the common Cuban species, *M. macquarti* Rondani, has the same habits.

Mallophora orcina Wiedemann. The "Southern bee-killer." This bumble-bee-like species is frequently met with in most parts of the South, occurring during the middle of summer in old fields and around the edges of corn and cotton fields, flying with a deep, dull hum and alighting on the stalks of weeds or low brush. I have never seen it kill or have I any record of its killing anything but Hymenoptera. It frequently seizes honey bees. Marlatt (1893) records this species as an enemy of yellow-

jackets (*Vespa communis* and *V. carolina*) in Maryland, while McAtee and Banks (1920, page 28) have listed among its prey "the bumble-bees, *Bremis impatiens*, *B. affinis* and *B. pennsylvanicus*, and the wasps *Polistes pallipes*, *Vespula vulgaris* and *Dolichovespula maculata*." Mr. C. T. Greene of the National Museum informs me that it is fairly common in the environs of Washington, D. C., where it feeds extensively on yellow-jackets, striking them in mid-air with an audible impact. Mr. C. W. Johnson has observed the same habit at St. Augustine, Fla., where he has noted them killing honey bees and bumble-bees. Charles Dury in "Random Notes on Natural History" (Jour. Cinn. Soc. Nat. Hist., Vol. XIX, No. 5, page 172) says: "In a field near Hyde Park this powerful robber fly was very abundant from June until October, 1899. Its favorite victims were Hymenopterous insects, mostly honey bees. I have several specimens taken in the act of killing bumble-bees larger than themselves; seventy specimens collected."

In Central Missouri, I took it feeding on scoliid and tiphia wasps, the honey bee, a large *cerceris* and, in one case, a large *polistes*, larger (longer at least) than the fly itself.

Mallophora bomboides Wiedemann. This large species is fairly common in Florida and along the sandy coastal strip as far north as Wilmington, N. C. It is found in the dry sandy scrub characteristic of this region, appearing in the late summer, a few being found in Southern Florida as late as January. It flies with a loud, deep buzz, alighting on the tips of shrubs or on the stalks of tall reeds. Its flight may be prolonged, and it frequently may be observed to zoom up into tree tops, presently returning to a resting place on the twig of a shrub nearer the ground. This species kills honey bees as well as the largest bumble-bees, carpenter bees and wasps. In Southern Florida, during a period when Hymenoptera were very scarce, I found it feeding on large beetles, reduviid bugs, and even grasshoppers.

Mallophora faultrix O. S. This fairly common western species, considerably smaller than *M. orcina*, but having also a bee-like habitus, has been taken in California feeding on honey bees.

Mallophora clausicella Macquart. This small, common, southern species is said by Mr. C. S. Brimley of Raleigh, N. C., to kill

honey bees. I have seen it preying on smaller solitary bees and do not doubt that it would be able to overcome the honey bee in spite of its size, which is less than that of the Hymenopteron. Such would be no more remarkable than the ability of its large relative *M. bomboides*, which I have taken feeding on a queen bumble-bee noticeably greater in bulk than its captor. McAtee and Banks (1920) recorded it as feeding on *Vespula germanica* and *V. vulgaris* and Banks (1913) took it with a bee, *Epeolus* sp.

Proctacanthus. The members of this genus are among the largest of our Eastern asilids. Probably all kill honey bees. Those definitely known to kill honey bees are *philadelphicus*, *rufus*, *milbertii*, and in the Far West, *occidentalis* and *arno*. The food predilections of our largest species, namely, the very rare *heros* Wiedemann found in the Southeastern States, are as yet unknown.

Proctacanthus philadelphicus Macquart is an abundant, late summer species in the Northeastern States, occurring as far south at least as North Carolina. It frequents dry fields and pastures where it flies up with a loud, sharp buzz taking an undulating course over the field until with a sharp turn it alights on a stone, dried patch of cow-dung or simply on the ground. The varying intonations of the buzz of one or two of these insects flying around within hearing of the observer suggest a mumbled conversation in the near distance, and it was evidently to this species that the late William Hamilton Gibson referred in his charming, popular books on nature as "The Talking Fly." Of about 300 prey taken from this species by the writer, more than two-thirds are Hymenoptera, with the honey bee well represented. Its favorite food seems to be worker yellow-jackets (*Vespa communis*, *diabolica*, and *vidua*) of which it destroys a great many. Worker bumble-bees of several species, the white-faced hornet, ichneumon flies, other Diptera, particularly other Asilids (including *Deromyia umbrina*, *D. misellus* and *Erax rufibarbis*) and small Coleoptera figure in the list of species taken, as do occasionally small grasshoppers.

Proctacanthus rufus Williston. This reddish species occurs in early and midsummer from Maine to Florida and Oklahoma, but its habitat is restricted to the sandy areas particularly along cer-

tain streams. In such places, it may be locally common. It is an active and wary species, generally alighting on the sand and is difficult to stalk and secure. Its prey seems to be pretty well restricted to Hymenoptera and honey bees figure as the largest item in the list of species that I have taken from it. It also captures numbers of *polistes*, other wasps, bumble-bees and even the white-faced hornet.

✓ *Proctacanthus milbertii* Macquart. The "Missouri Bee-Killer." This is one of the largest and most widely distributed species of the genus. It ranges from Mississippi, Texas and New Mexico to Ohio and Virginia, northwest to British Columbia, and is a characteristic species of the prairies and the plains. I found it very abundant in dry fields in Missouri during the late summer. Although this species was recorded by Riley (1870) as a particular enemy of bees, my observations failed to bear this out. I obtained a large series of prey in Missouri and the vast majority were grasshoppers, butterflies and skippers. I did not take it with a single honey bee, although in many fields where it occurred, both *D. discolor* and *Mallophora orcina* were also present and feeding on honey bees. That it does on occasion take honey bees is certain, but I am inclined to classify this species as one that generally prefers insects of the "fluttering" type of flight rather than the "buzzing." Riley in later papers records it as an enemy of the Rocky Mountain locust and also of the cotton worm, and I believe that such insects figure much more in its menu than do honey bees. Walton (1914, p. 174) in New Mexico found it preying largely on immature grasshoppers. Davis (1919, p. 89) and Wallis (1913) have recorded its preying on cicindellid beetles.

Proctacanthus occidentalis Hine. This large, elongate species occurs on the dry prairies and mesas of California, Oregon, Washington and British Columbia, and possibly slightly eastward. On the one occasion I found an individual with prey, the victim was a worker honey bee.

Proctacanthus arno Townsend. I took this species in Southwestern Arizona feeding on an alfalfa butterfly, a large apio-cerid fly and a worker honey bee.

Erax. The only time I have taken a species of this genus with a honey bee as prey was on June 28, 1925, near Arlington, Ari-

zona, where I found a female *Erax pernicis* Coquillett resting on the side of a mesquite bush with a worker honey bee in its grasp.

Erax rufibarbis Macquart is a common species in the East and large enough to overcome honey bees, but I have never seen it capture one, although I have watched it closely in the field and disturbed bees on flower heads to make them fly in range of the asilid. In all cases, the fly paid no attention, even in the same field where *Proctacanthus philadelphicus* was seizing the bees at every opportunity. I have collected a great deal of food material from *E. rufibarbis*, but this has been composed mostly of other diptera, winged ants, small solitary bees, small butterflies, etc. I was quite surprised, therefore, to note in the North Carolina State collection at Raleigh, a specimen (female) with a worker honey bee as prey. The data on this specimen was Moncure, N. C., X, 6, 1921. T. B. Mitchell.

Erax interruptus Macquart is listed by Cook as a bee-killer (the name *Erax* only is given, but the picture identifies it in spite of the fact that the venation is incorrectly drawn). Here again, although I have tried to coax, in the manner above alluded to, the species to take bees, the effort was not attended with success. This species, abundant in most parts of the South from Virginia to Florida and Southern California, I have found to be partial to butterflies and grasshoppers, seizing individuals of the latter much larger than itself. It occurs in old fields, pastures and cultivated fields and has received several local common names, such as "fly-hawk," "path-finder" from its habit of alighting in paths through pastures and fields, and "Snorey Joe" from its sonorous buzzing. Under the name *Erax apicalis*, Comstock (1879) pictures and refers to it as an enemy of the cotton leaf worm, while Malley (1902) records it under the name *Erax lateralis* as feeding on the boll-worm adults. It is, I believe, from the standpoint of the feeding habits of the adult, one of our most beneficial as well as abundant and wide-spread Asilids.

While, therefore, it is possible that some species of *Erax* may occasionally feed on honey bees, the evidence points to their activities in this respect as being not at all comparable to the destruction caused by the major bee-killers, such as *Promachus* or *Deromyia*.

CONCLUSIONS

It may be surmised from the foregoing that robber flies can cause economic losses only where a certain combination of conditions exist. This demands a great abundance of a bee-killing species in the close vicinity of the apiary. Probably the only species in this country for which these conditions would obtain would be *Promachus fitchii* O. S., which might be sufficiently numerous in a field near an apiary to cause considerable damage. As it would occur in fields heavily infested with white grubs on which the larvæ feed, the obvious control would be to pasture the fields to hogs if this were practical. The latter would probably feed on and to a considerable extent rid the field of both white grubs and asilid maggots. Fall plowing of the infested fields might also be suggested as a control method.

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PLATE X

- Figure 1. *Promachus fitchii* O. S. The "Nebraska Bee-killer." Natural size.
- Figure 2. *Deromyia umbrina* Loew. A common "bee-killer" in New England. Natural size.
- Figure 3. *Mallophora ruficauda* Wied. The Argentine "Bee-killer." Natural size. Received from Dr. Andrés Capello.
- Figure 4. *Proctacanthus philadelphicus* Macq. A common "bee-killer" in the Northeastern States. Natural size.
- Figure 5. *Stenopogon* sp. with honey bee. A "California Bee-killer." Slightly enlarged.



ROBBER FLIES

A REVIEW OF THE GENUS MYRMOTERAS (HYMENOPTERA, FORMICIDÆ)¹

BY WILLIAM S. CREIGHTON

Among a number of archaic genera which belong to the subfamily Formicinae none is more striking than the singular Indo-Malayan genus *Myrmoteras*. The ants of this group possess enormous, reniform eyes, a character found in other ancient genera, and in addition, show a curious occipital fold and a mandibular structure unique among the Formicinae. The mandibles are linear, greatly elongated and with a number of sharp, well-separated teeth along their inner border. The mandibles themselves are consequently not unlike those of the primitive Ponerine genus *Myrmecia*. The mandibular mechanism taken as a whole is, on the contrary, totally dissimilar to that of *Myrmecia*, being closely analogous to a type found in the highly developed Ponerine genera *Anochetus* and *Odontomachus* and the peculiar Myrmicine genus *Strumigenys*. This blending of primitive and specialized characters in *Myrmoteras* is sufficiently unusual to repay careful consideration.

It has been observed that many of the species in the three genera just mentioned utilize the mandibles in a form of leaping to which Wheeler has applied the term retrosalience. The type of mandibular structure upon which retrosalience depends, although differing widely in detail, is remarkably uniform as regards fundamental organization. In all the known retrosalient forms the mandibles are linear and inserted close together. This results in a marked narrowing of the front of the head. The occipital angles have undergone linear or lateral expansion or both, apparently to permit the attachment of a large number of mandibular muscles. There has been developed a trigger mechanism consisting of two or more hairs which project forward and slightly downward. The details of this rather complex mechanism, on the other hand, are exceedingly variable. Thus

¹ Contributions from the Bussey Institution, Harvard University No. 336.

in *Odontomachus* (Fig. 1, C) and most of the species of *Anochetus* (Fig. 1, D) the dentition of the mandibles is ordinarily reduced to two or three stout, apical prongs. The other teeth, if present, are represented by small denticles along the inner border of the mandibles, which meet but do not overlap, just as do the cutting edges of a pair of electrician's pliers. The occipital angles have been produced through linear expansion into two prominent lobes. The trigger hairs are usually four in number, two hairs arising near the base of each mandible. These are brought into an effective position only when the mandibles are wide open. In contrast to this we find in *Strumigenys* (Fig. 1, A) that the mandibles are much more slender than those just described. Although the apical prongs are similar the inner edges of the mandibles do not meet and in some species bear widely separated teeth which may approach the apical prongs in size. The occipital angles have undergone both linear and lateral expansion which has resulted in the production of the cordate head characteristic of *Strumigenys*. The trigger hairs, when present, are two in number and arise from the lower edge of the labrum which hangs perpendicularly from the clypeus between the insertion of the mandibles. In certain species the base of the mandible is hollowed to permit the reception of the edge of the labrum. In some of the species of *Strumigenys* the trigger hairs are absent. This is true of *S. cordobensis* Mayr and apparently of *S. godeffroyi* Mayr also. It seems possible that this absence of trigger hairs may explain why certain members of this genus, although otherwise identical with the retrosalient species, have never been observed to leap.

As has already been noted the cephalic characters of *Myrmoteras* (Fig. 1, E) are very similar to those described above. The unusually long and slender mandibles are inserted relatively close together. The occipital angles are laterally expanded. There is a trigger mechanism consisting of two very long and exceedingly thin hairs which arise from the forward edge of the labrum. This structure in *Myrmoteras* is closely applied to the under side of the clypeus and lies entirely above the mandibles. The basal portion of the trigger hairs slopes forward and downward so that the hairs lie beneath the mandibles to which they

are parallel throughout most of their length. The above similarities have been taken as an indication that *Myrmoteras* is a retrosalient form and such a conclusion appears to be amply justified. Unfortunately the almost complete lack of field observations on the ants of this genus leaves us without definite proof of this habit but, as will be subsequently shown, although *Myrmoteras* may not display this trait, there can be little doubt that it should be classed with a number of other genera which

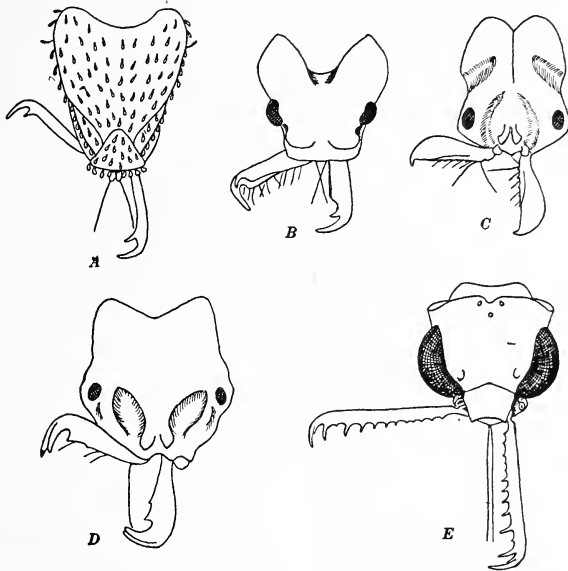


Figure 1. Diagram showing the relation between the length of the trigger hairs and that of the mandibles. A. *Strumigenys gundlachi* Roger. B. *Daceton armigerum* Perty. C. *Odontomachus haematodes* subsp. *laticeps* Roger. D. *Anochetus mayri* Emery. E. *Myrmoteras mjoebergi* Wheeler.

might be characterized as trap-jawed. This group would include the retrosalient genera mentioned above and also *Daceton*, *Acanthognathus*, *Orectognathus*, *Microdaceton* and *Epitritus*. The heads of representative forms of some of the above genera are shown in Fig. 1. As may be seen from this figure there is a correlation between the length of the trigger hairs and the length of the mandibles. The tendency of the hairs to curl when dry makes it difficult to obtain exact measurements but in general it

may be stated that the tips of the trigger hairs reach a point greater than one-half and less than six-sevenths of the distance from the base to the apex of the mandibles when the latter are closed. This insures that the external object which springs the trap will be within the grasp of the closing mandibles and should be impaled on the apical prongs.

That the above result is the primary function of this type of mandibular mechanism appears fairly certain. In the retrosalient species however the same mechanism occasionally operates to produce backward leaps of the insect. This process has been described by a number of observers, particularly in the case of *Odontomachus*, which may be regarded as the exemplar of this type of leaping. The action is essentially as follows:

Prior to the leap the mandibles of the insect are opened to their greatest extent so that they stand at right angles to the long axis of the head or are directed slightly backward. At the same time the antennæ are held in such a position that their tips project forward and inward. Upon the contact of these with some external object the insect suddenly advances and when the trigger hairs touch the object the mandibles are snapped against it with the resulting backward leap of the insect.

Although this process has been repeatedly described very little attention has been paid to the mechanics involved. This may be because the action appears fairly obvious but is probably more largely due to its extreme rapidity which makes it impossible to follow the movements of the mandibles. A consideration of the mechanics of retrosalience must consequently be derived largely from the structure of the parts involved coupled with what can be observed of their action at the time of leaping. Such a study leads to a number of interesting conclusions. I am indebted to Dr. Gerald Almy for his helpful suggestions in the following discussion:

Observable facts in the leaping of retrosalient forms indicate that the process might be carried out in two ways. It is possible that the mandibles might be brought against some small, hard object with a scissor-like action in which the pressure would be applied by the inner edge of each mandible as these slipped along the object. This *modus operandi* would require tre-

mendous pressure to produce an effective leap and would be defeated by the occurrence of teeth along the inner border of the mandible. Since these are always present, although sometimes reduced to two terminal hooks, this explanation may be discarded. The alternate explanation assumes that the tips of the mandibles are driven against some hard object which is too large to be included in their grasp. The tips then slide over the surface of the object and the ant is thrown backward. This process, if repeated many times would tend to wear down the terminal teeth since these are the only part of the mandible in contact with the object. It is by no means unusual to find specimens, particularly in the case of *Odontomachus*, in which the terminal teeth are blunted with the worn surfaces heavily scratched. If the above explanation is correct retrosalience depends as much upon the size and consistency of the object struck as upon the mandibular organization of the ant. In view of the habits of the retrosalient forms this fact is of considerable significance. Wheeler² has drawn a vivid picture of the ferocity with which the workers of *Oodontomachus* attack and dismember living insects placed in their nests. The appendages of the victims are at once nipped off by the plier-like jaws of the *Odontomachus* workers. The most casual inspection of the ants depicted in Figure 1 will show that this cannot be true of *Strumigenys* or *Myrmoteras* since the edges of the mandibles are not developed to permit a nipping action. Nevertheless the structure of the mandibles in each of these genera seems equally bound up with a trophic peculiarity. One of the few field observations which we possess for *Myrmoteras* was given me by Dr. Jas. W. Chapman who took *M. williamsi* in the Philippines. The specimens which he secured were slow and clumsy in movement. This is also true of every species of *Strumigenys* which the author has been able to observe. If we assume that the members of both these genera depend upon small and rather active insects for food the explanation for their peculiar mandibular organizations is at once apparent. While the efficacy of the mandibles as a cutting instrument would be nil they would function in the same manner as the jaws of a steel trap and by suddenly snapping

² A Study of Some Texan Ponerinæ. Biol. Bull. Vol. II, No. 1. 1900.

shut would impale insects whose agility would otherwise render them impossible of capture. It is interesting to note that there is an analogous type of trap mechanism in the angler fishes, (Lophiidae) which enables them to capture other fishes more active than themselves.

The extraordinary parallelism in the mandibular organization of the various genera of ants mentioned at the beginning of this paper may be regarded as a case of convergence in response to a definite type of feeding habits. That the mandibles should also function in leaping is, I believe, entirely fortuitous. Practically all ants will, if sufficiently aroused, attack anything within reach. In the case of the retrosalient forms this attack, if the object bitten is of a suitable size and hardness, results in a backward leap of the insect. Although it is freely admitted that retrosalience serves at times to promote safety I am strongly averse to the view that this outcome has any fundamental significance in the ethology of the species. Escape under such circumstances differs in no way from that which occurs when an ant pursued by some predaceous enemy chances to tumble off a leaf and is thus accidentally removed from danger. To assume a more integral rôle for retrosalience necessitates the belief that the insects, when in danger, deliberately select some suitable object against which to strike the mandibles. In my opinion such a view is untenable.

If it is true that retrosalience is to be regarded as an ethological by-product we may amplify a concept advanced by Wheeler in a publication of 1922.³ In this paper evidence was presented to demonstrate that prosalience, which is shown only by forms having elongated and thickened hind femora, is a characteristic confined to very primitive, macrophthalmic species. The large size of the eyes is apparently a necessary corollary to this type of leaping which might, as a further distinction to retrosalience, be called intentional. That prosalience plays a vital part in the ethology of the few archaic species which still show it is evident from Wheeler's remarks on *Gigantiops*. This ant, although conspicuous and a solitary forager, is able to

³ Observations on *Gigantiops destructor* Fabr. and other leaping Ants. Biol. Bull. 1922, pp. 185-201.

escape capture by its agile leaps. The disappearance of pro-salience in the great bulk of our present day Formicidæ Wheeler attributes to an increase in social organization which led to a decrease in the size of the eyes and a consequent readjustment of habits. Retrosalience on the other hand appears to be completely independent of habits or of the size of the eyes. It is fairly certain that the small size and peculiar position of the eyes in *Strumigenys* renders these insects virtually blind yet this lack of any means of visual orientation has not prevented the development of a trait in which this would seem to be of vital importance. Similarly in *Odontomachus* and *Anochetus* the value of the small eyes in orientation may be questioned. If, therefore, future field observations confirm the supposition that *Myrmoteras* is retrosalient it must be borne in mind that, although the ants of this genus are primitive and macropthalmic, the trait of leaping is in this case a secondary development which has little or nothing to do with the primitive characters.

The genus *Myrmoteras* was established by Forel in 1893 from a series of workers taken in the Thaungyin Valley (Tennaserim), Burmah. This ant, to which he gave the name *binghami*, was for a number of years the only known representative of the genus. In 1916 Wheeler described the female of a new species, *M. donisthorpei*, from Borneo and three years later *bakeri* and *williamsi*, both described from females. The first species was taken in Borneo, the last in the Philippines. In the present paper the workers of two new species are described, *mjoebergi* from Borneo and *barbouri* from Java. A description of the worker of *williamsi*, which has hitherto been unknown is also given. A single female and two workers of this species were taken by Dr. Jas. W. Chapman at Dumaguette, P. I. These specimens Dr. Chapman generously turned over to me for examination and I wish to express my sincere thanks for this courtesy. A comparison of two castes shows that, except for the slightly longer mandibles of the worker, the cephalic characteristics are identical. This is of great importance in the separation of the described species, since two are known only from females while three have been founded upon workers. Since the difference between the head of the female and that of

the worker is negligible a key based upon cephalic characteristics may include both castes. There is a single cotype of *binghami* in the collection of Dr. W. M. Wheeler, who has kindly allowed me to examine this species as well as the types of the species which he has described. It is possible, therefore, to present a review of the genus with the description of the new forms. I wish to thank Dr. Wheeler for his coöperation in permitting me access to the types and also for his consideration in turning over to me, for inclusion in this paper, the original description of the new species *mjoebergi*.

As might be expected of an archaic genus, whose members have, through isolation, become very distinct, the species of *Myrmoteras* show conspicuous differences in the shape of the head, the length of the antennal scapes, the number of mandibular teeth and the details of sculpture and pilosity. The following key presents an analysis of these differences:

KEY TO THE SPECIES OF THE GENUS MYRMOTERAS

1. Frontal furrow well developed, extending back to the median ocellus.....2
Frontal furrow absent or represented only by an obsolete impression
which does not extend behind the anterior third of the head.....5
2. Head opaque, completely coriaceous except the occipital fold.....*williamsi*
Head smooth and shining, the sculpture, if present, consisting of striæ
on the front and clypeus3
3. Head entirely smooth*bakeri*
Front and clypeus striate4
4. Mandibles with fourteen teeth, the denticles between the apical tooth
and the penultimate tooth not well developed; length of the female
4.5 mm.*donisthorpei*
Mandibles with nine teeth, the denticles between the apical tooth and
the penultimate tooth well developed; length of the worker 5.3 mm.
binghami
5. Head completely smooth and very highly shining*mjoebergi*
Head subopaque, finely and feebly coriaceous*barbouri*

Myrmoteras bakeri Wheeler

M. bakeri Wheeler, Bull. Mus. Comp. Zool. Harvard, Vol. 63, p. 145, (1919) ♀ ♂

In the original description of *bakeri* Wheeler surmised that it might prove to be nothing more than a form of *donisthorpei*. The specific status of *bakeri* can, however, scarcely be ques-

tioned. Although in size and general appearance the two forms are similar, *bakeri* is much paler, the front and clypeus bear no striæ and the dentition of the mandibles is quite different (see Plate 1, Fig. 5). The mandibles of *bakeri* have only nine teeth with three additional denticles borne singly between the terminal and second, the second and third and the third and fourth apical teeth. The integument in the type is translucent and because of this the frontal furrow and the circumocular grooves appear unusually prominent. Whether this translucence is constant for the species is open to doubt but, if so, it furnishes a very easy means of recognition. The color of *bakeri* is a clear, golden yellow with the mandibular teeth and the thoracic sutures tinged with red.

Type locality: Sandakan, Borneo (Baker).

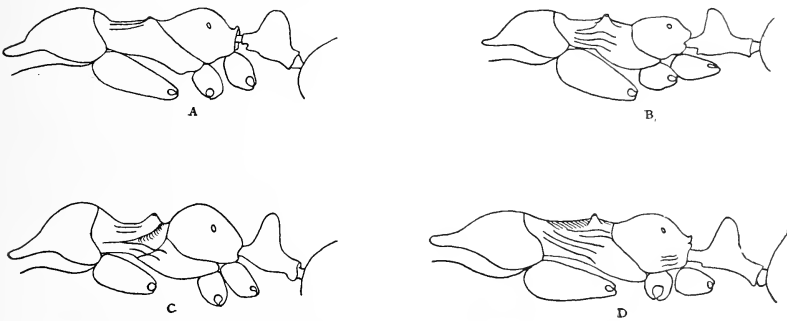


Figure 2. Thorax of the worker of: A. *M. mjoeborgi* Wheeler, sp. nov. B. *M. binghami* Forel. C. *M. williamsi* Wheeler. D. *M. barbouri*, sp. nov.

***Myrmoteras barbouri* sp. nov.**

WORKER: Length over all 6.9 mm.

Occipital fold deeply impressed in the middle, the ocelli borne on low and obtuse projections, a moderate concave impression between the lateral ocelli. Frontal groove virtually obliterated, represented only by a feeble impression which extends only a little way behind the level of the insertion of the antennæ. Mandibles with five apical teeth which gradually decrease in length and five small basal teeth. No denticles between the terminal tooth and the penultimate tooth. For other details of cephalic structure see Plate XI, Fig. 6.

Thorax seen in profile (Fig. 2, D) with the pronotum feebly convex, the mesonotum only moderately depressed, the tubercles bearing the mesothoracic spiracles prominent. Epinotum evenly convex, without distinction

between the basal and declivious faces. Seen from above the pronotum is fan-shaped, one-fifteenth longer than broad (the neck excluded). Mesonotum only slightly more than one-third as wide as the pronotum, its sides approximately parallel. Epinotum subpyriform, slightly less than twice as wide as the mesonotum. Node of the petiole seen in profile with a blunt summit, both anterior and posterior faces sloping from crest to base, the posterior face slightly longer. Anterior and posterior peduncles of about equal length.

Ferrugineous, the mesonotum and epinotum slightly tinged with black, the petiole and abdomen brownish red, the mandibles antennæ and legs yellowish brown. The head covered with a delicate, subopaque coriaceous sculpture except for an oval area in the middle of the clypeus which is feebly striate and dull and the rim of the occiput, the occipital fold and the genæ which are smooth and shining. Pronotum moderately shining with very feeble coriaceous sculpture. Mesonotum with numerous strong irregular rugæ on the dorsum and five rugæ extending across the anterior half of the sides. Epinotum very feebly coriaceous, shining with fine wavy rugæ behind the spiracles and somewhat coarser rugæ on the lower portions of the sides. Hairs sparse, thin, erect and yellow.

Type: M. C. Z. No. 16231.

Described from a single worker taken by Dr. Thomas Barbour at Singdanglalia, Java.

Barbouri is the largest known member of the genus. Its characteristic cephalic sculpture readily distinguishes it from any of the other species with the possible exception of *williamsi*. In *williamsi* however, the sculpture is much heavier and more opaque and the two are totally dissimilar in size, shape of the head and dentition of the mandibles.

Myrmoteras binghami Forel

M. binghami Forel, Ann. Soc. Ent. Belg. Vol. 37, p. 607, (1893)
♂. Forel, Jour. Bombay Nat. Hist. Soc. Vol. 8, p. 419,
(1894) ♀. Bingham, Fauna Brit. India, Hym. Vol. 2, p.
314, fig. 95, (1903) ♀. Emery, in Wytsman, Genera In-
sectorum Fasc. 183, Subfamily Formicinæ (1925) Plate
2, Fig. 1.

The front and clypeus of *binghami* are feebly reticulo-striate. This character separates it from all the other species except *donisthorpei* which has a similar sculpture. The pronounced difference in size, in the shape of the head and in the dentition of the mandibles prevents any possibility of confusion of these

two species. The mandibles of the worker of *binghami* bear nine acute teeth, the basal four short, the apical five gradually increasing in length. Between the terminal tooth and the penultimate tooth are two well developed denticles, the more apical of these about twice as long as the inner. For other cephalic characters the reader is referred to Plate XI, Fig. 2.

In thoracic structure *binghami* (Fig. 2, B) closely approaches *barbouri* but differs in its more angular epinotum and less extensive mesonotal sculpture. The basal face of the epinotum is very feebly convex and separated from the much shorter declivous face by a well marked angle. The dorsum of the mesonotum lacks the conspicuous transverse rugæ which are present in *barbouri* and there are only four rugæ on the sides. The mesonotal tubercles are prominent but the spiracular openings themselves are quite small. The node of the petiole seen in profile has an almost perpendicular anterior face, a flattened summit and a straight and steeply sloping posterior face. Length over all: 5.3 mm.

Type locality: Thaungyin Valley, (Tenasserim) Burmah.

Myrmoteras donisthorpei Wheeler

M. donisthorpei Wheeler, Proc. New Eng. Zool. Club, Vol. 6, p. 14, fig. 3, (1916) ♀. Emery, in Wytsman, Genera Insectorum, Fasc. 183, Subfamily Formicinae, Plate 1, fig. 16, (1925).

In *donisthorpei* the front and clypeus bear numerous fine wavy striae. A similar condition is found in *binghami* but the striae in that species are feebler and more broken up and the entire head is duller. The pronounced size difference in the two further eliminates any possibility of confusion. The mandibles of *donisthorpei* have the external border very feebly curved throughout. In this particular it appears to be unique in the genus. The inner border of the mandibles bear twelve teeth which gradually increase in length toward the apex. The denticles between the second and third and the third and fourth apical teeth are unusually well developed, being considerably larger than some of the basal teeth, consequently it is perhaps less confusing to regard the mandibles as having fourteen teeth

rather than twelve as first stated. The customary two denticles are present between the apical tooth and the penultimate tooth but the innermost one is so small and closely applied to the base of the other that it is difficult to see. A figure of the head of the female of *donisthorpei* is given in Plate XI, Fig. 3. The node of the petiole of *donisthorpei* is moderately thick with a blunt summit which meets the almost perpendicular anterior face at a well marked angle but passes to the more sloping posterior face through a convex declivity. Length over all (female) 4.5 mm.

Type locality: Mt. Matang, (Sarawak) Borneo (G. E. Bryant).

The following description of the new species *mjoebergi* is that of Dr. W. M. Wheeler, through whose kindness I am able to present it here:

***Myrmoteras mjoebergi* Wheeler, sp. nov.**

WORKER: Length 5-5.6 mm.

Very similar in form to the other species of the genus. Antennal scapes extending nearly two-fifths of their length beyond the posterior border of the head. Basal teeth of the mandibles longer and more distinct. In all there are ten teeth, counting the apical as the first. In the diastema between the first and second there are two denticles, the subapical being fully one-third as long as the apical, the other minute. A similar minute denticle is present in the diastema between the second and third and third and fourth teeth. Pronotum decidedly more rounded and convex than in *M. binghami* and *barbouri*. Base of the epinotum convex above, about twice as long as the declivity, which is straight and sloping. Petiole fully twice as long as broad, longer than high, the node thicker than in *binghami*, somewhat compressed laterally, in profile bluntly and evenly rounded above, its superior border from behind transverse and feebly arcuate. Appendages as in the other species, with the middle and hind tibiae and the tips of the scapes incrassated.

Sculpture quite different from that of the other species, the whole body smooth and shining, with minute piligerous punctures, which are very inconspicuous on the head, thorax and abdomen and somewhat more numerous on the appendages. Concavity of the mesonotum indistinctly transversely striate.

Hairs white, delicate, erect, very sparse on the body, distinctly more abundant but somewhat shorter on the appendages. The funiculi, as in the other species, are clothed with erect hairs nearly as long as those on the scapes.

Castaneous brown; appendages yellow; mandibular teeth, tips of scapes, funiculi, bases of coxae, extensor surfaces of legs, incisures of gastric segments and venter darker, reddish or yellowish brown.

Described from three specimens taken by Dr. E. Mjöberg on the summit of Mt. Tibang, Dutch Borneo, at an altitude of 1,700 meters. This is the third species of *Myrmoteras* to be described from Borneo which would seem to be the metropolis of the genus.

Mjöbergi is distinct from all the other species in the genus because of its highly shining surface which, except for a few very small punctures, is virtually free from sculpture. The longitudinal striæ of the sides of the mesothorax are reduced to two, one terminating directly in front of the spiracle, the other, which is shorter and more feeble, parallels the first and ends below and well to the front of the spiracle (Fig. 2, A). The mesothoracic spiracles are less conspicuous than in the other species, being borne on a broad, obtusely triangular elevation which gives them the appearance of being fused into the dorsum of the mesothorax. The frontal furrow is absent. The head of *mjöbergi* is shown in Plate XI, Fig. 1.

Myrmoteras williamsi Wheeler

M. williamsi Wheeler, Bull. Mus. Comp. Zool. Harvard, Vol. 63, p. 146, (1919) ♀.

WORKER (not before described): Length over all 3.9 mm.

Head as in the female (see Plate XI, Fig. 4) except that the mandibles are relatively longer, being approximately one and one-third times the length of the head, and bear two additional basal teeth. There are two small denticles between the apical and penultimate teeth and one larger denticle between the penultimate and third and the third and fourth teeth.

Thorax seen from above with the pronotum subspherical. The mesonotum is stalk-like, scarcely one-third as wide as the pronotum, its sides virtually parallel except posteriorly where they diverge slightly at the junction with the epinotum. Epinotum narrowed anteriorly, broader and with subparallel sides behind, its greatest width slightly less than one-half as wide as the mesonotum. Seen in profile (Fig. 2, C) the pronotum itself is only moderately convex but since the premesonotal suture is feeble and the transition to the steeply declivious and strongly depressed mesonotum is not sharply defined, the pronotum appears strongly convex. Mesothoracic spiracles borne on prominent tubercles. Mesoepinotal suture feeble on the sides but with a pronounced concave impression on the dorsum. Epinotum in profile strongly convex with the posterior face straight and sloping. Node of the petiole in profile with the summit rather narrowly rounded, the anterior and posterior faces very steeply declivious, the height of the node one and one-third times as great as the length of

its base, the posterior peduncle slightly longer than the anterior and feebly expanded behind.

Head opaque, completely coriaceous, the antennal scapes and the base of the mandibles dull, with numerous fine punctures, the remainder of the mandibles strongly shining. Pronotum completely opaque, finely coriaceous, base of the first coxa finely coriaceous. Mesonotum shining with a few very coarse and widely separated striae. Epinotum feebly coriaceous above but not completely opaque, the sides strongly shining. Petiole and gaster shining. Hairs on the head and thorax and abdomen short sparse and erect, somewhat more numerous and shorter on the appendages.

The above description is drawn from material secured by Dr. Jas. W. Chapman at Dumaguete, P. I. Since two workers and a female were taken it has been possible to compare the latter caste with the types of *williamsi*. Except that the head of Dr. Chapman's specimen is slightly darker the two are identical. This color difference is far too slight to be of any taxonomic significance.

It is unnecessary to describe in detail the female of *williamsi*. The head of this insect is shown in Plate XI, Fig. 4. The thorax is rather short and stout with the dorsum strongly convex. The pronotum, scutum, scutellum, basal face of the epinotum and the episternum are coriaceous and opaque. The sides and the declivous face of the epinotum and the metapleuræ are covered with fine interrupted, feebly shining striae. Wings smoky, iridescent in certain lights, the veins dirty yellow. In other regards as in the worker. Length over all 4.3 mm.

Localities: Los Banyos, Philippine Islands, (Type loc.) (F. X. Williams); Dumaguete, Philippine Islands, (Dr. Jas. W. Chapman).

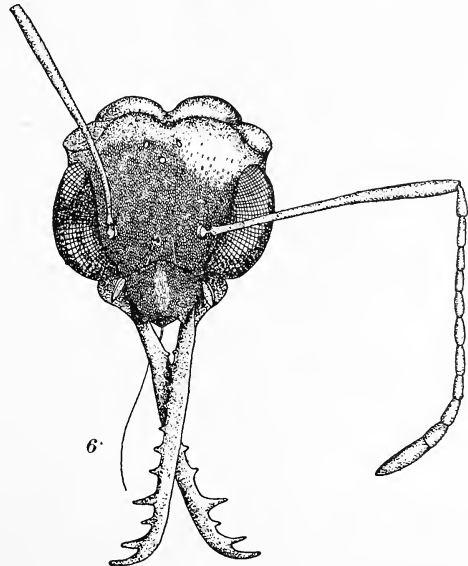
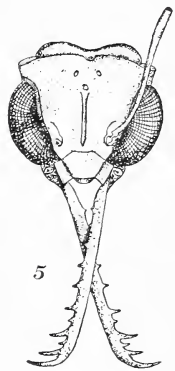
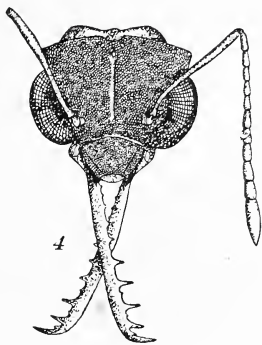
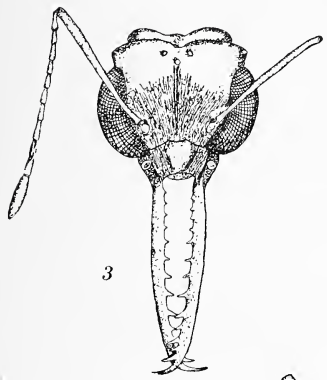
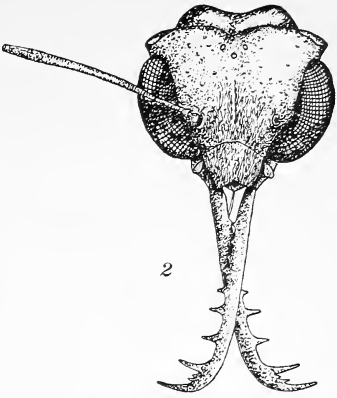
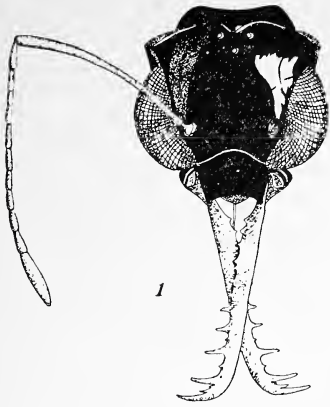
Both the worker and female of *williamsi* may be readily distinguished by the coriaceous sculpture which renders the head completely opaque. An approach to this condition is found in *barboursi* but in the last species the sculpturing is not sufficiently heavy to cause complete opacity. Furthermore confusion of these two species is very unlikely because of the marked difference in size. The frontal furrow in *williamsi* is unusually prominent, extending from a point opposite the insertion of the antennæ back to the median ocellus. In the structure of the

thorax the worker of *williamsi* differs notably from that of any of the other species in which this caste is known. The very strong depression of the mesonotum makes the pronotum and epinotum appear very gibbous. The concave impression at the mesoepinotal suture is apparently peculiar to *williamsi*. The characteristic sculpturing of the thorax has already been described.

PLATE XI

The figures are drawn to the same scale and can be used in comparing the size of the various species.

- Figure 1. Worker of *Myrmoteras mjoebergi*, Wheeler.
- Figure 2. Worker of *Myrmoteras binghami*, Forel.
- Figure 3. Female of *Myrmoteras donisthorpei*, Wheeler.
- Figure 4. Female of *Myrmoteras williamsi*, Wheeler.
- Figure 5. Female of *Myrmoteras bakeri*, Wheeler.
- Figure 6. Worker of *Myrmoteras barbouri*, Creighton.



MYRMOTERAS

PHILIPPINE ANTS OF THE GENUS ÆNICTUS WITH
DESCRIPTIONS OF THE FEMALES
OF TWO SPECIES

BY WILLIAM MORTON WHEELER

On returning to the United States from a second sojourn of six years at Dumaguete, on the Island of Negros, Dr. Jas W. Chapman has brought another extensive collection of Philippine ants. Among them are numerous specimens taken from more than 40 different Ænictus colonies, and comprising the extraordinary females of two of the species (*Æ. læviceps* F. Smith and *martini* Forel), together with the larvæ, insect prey and myrmecophiles (ænictophiles) of many of the foraging and bivouacking armies. Dr. Chapman will publish his ethological observations in a separate paper. The following taxonomic account, for which he has very generously contributed the specimens, should supersede our notes on the Philippine Ænieti published in our joint paper of 1925 and based on rather meager material.

The genus Ænictus comprises some 119 described forms (82 species, 11 subspecies, 26 varieties) and is both taxonomically and ethologically the least adequately understood of the larger genera of Doryline ants. It is confined to the Old World, where it replaces the closely allied New World genus Eciton, but it has a very wide range, embracing the whole of Africa, the Indomalayan and Papuan Regions and Northeastern Australia. Most of the forms inhabit the Indomalayan Region (42 species, 7 subspecies, 17 varieties), but the African representation is not greatly inferior (34 species, 4 subspecies, 9 varieties). At the extreme limits of the range, however, the number of forms is greatly diminished, there being only six species in Africa north of the Sahara (Morocco, Oran, Tunis) and only three in Australia (Queensland, New South Wales). No Ænictus occurs in the Malagasy Region, which also lacks any species of Dorylus, the only other Old World genus of the subfamily Dorylinæ.

We must suppose, therefore, that Madagascar was isolated either before this subfamily had been evolved or, more probably, since these ants are very archaic, before they had migrated to East Africa from some hypothetical center of origin in the Northern Hemisphere. Since the females of the Dorylinae are clumsy, apterous insects, unable to found colonies without the aid of workers, we can hardly assume that they have been introduced into islands either with flotsam and jetsam or by human agencies. To account for the several species on the East Indian and Papuan Islands and in Australia, we must, therefore, suppose that they reached their present habitat before these islands were separated from the Asiatic mainland.

In *Ænictus*, as in the other genera of Dorylinae, the correlation of the workers, females and males of any particular species, unless found together in the same colony, is impossible. The singular females are among the rarest of insects in collections, which usually consist of series of workers taken from foraging columns or of a few males taken at lights. Hence most of the described forms are based either on workers or on males only, so that the actual number of species is undoubtedly considerably less than the number recorded in our catalogues. The latter show that 45 forms (28 species, 1 subspecies, 16 varieties) have been described from worker specimens exclusively, 68 (48 species, 10 subspecies, 10 varieties) from males only, and that only three species have been described from both worker and male. Two are known only from single female specimens and one from both worker and female. The following table gives the numbers of the described forms according to caste and geographical distribution:

A study of the specimens and descriptions of the known workers, and especially of the females and males indicates that the genus *Ænictus* is decidedly heterogeneous, though previous to 1929, when I described a species, *Æ. silvestrii* from Penang Island, as representing a distinct subgenus, *Parænictus*, no attempt had been made to subdivide the genus. But that its species are sufficiently diverse to justify further subdivision is apparent from the following considerations: first, the males show great differences in the structure of the head, scapes, petiole,

	Species	Subspecies	Varieties	Totals
No. of Forms	82	11	26	119
Known from workers only	28	1	16	45
Known from males only	48	10	10	68
Known from males and workers only	3	—	—	3
Known from females only	2	—	—	2
Known from worker and female only	1	—	—	1
Indomalayan forms	42	7	17	66
African forms	34	4	9	47
Papuo-Australian forms	6	—	—	6

legs and genitalia; second, certain peculiar males, comprising seven species and known only from the Congo, have been assigned to a separate genus *Ænictogeton* by Emery and Santschi, though very probably the cospecific workers of some of them have been described already as species of *Ænictus*; and third, the females of *Æ. laviceps* and *martini*, discovered by Dr. Chapman and described below, differ so widely from the three females previously known that they would seem to belong to a distinct genus, though Forel and Emery have not hesitated to place their workers in the genus *Ænictus*.

The three known females of *Ænictus* were all taken in Africa. In 1885 Ernest André described from Oran a peculiar ant which he regarded as a worker and named *Alaopone abeillei*. Emery, in 1895, renamed it *Dorylus (Shuckardia) abeillei* on the basis of the description, but on seeing the specimen while he was visiting André, he concluded that it must be an *Ænictus*, and, therefore, described and figured it in two of his papers (1901, 1904). I reproduce his sketches of the insect (Fig. 1), which measures 8 mm. and is reddish yellow. It closely resembles the females of the subgenus *Acamatus* of the genus *Eciton*, except that its antennæ are 10-jointed, instead of 12-jointed, the thorax more slender and especially the head and petiole much narrower. A second *Ænictus* female was described and figured by Emery.

in 1914 as that of *Æ. vaucheri*. It was taken in Morocco and measured 9 mm. Its color was reddish brown. In structure it closely resembled *Æ. abeillei*, but its head was broader and more quadrate, with more clavate antennal scapes. Both of these females were obviously virgins, or at any rate had undeveloped ovaries, since their abdomens exhibited no distension of the in-

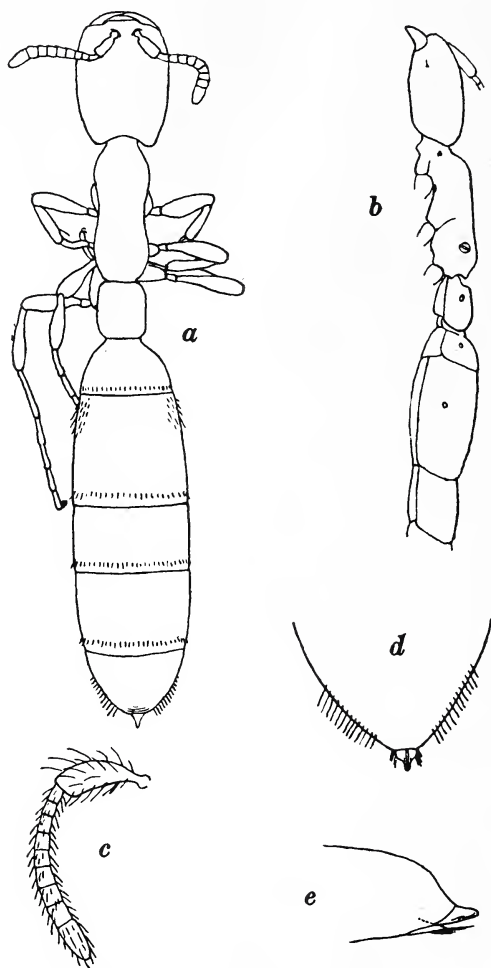


FIG. 1. *Enictus abeillei* Ern. André. Female. *a*, dorsal view of type; *b*, lateral view of body except posterior end; *c*, antenna; *d*, posterior end of abdomen, dorsal view; *e*, same in profile. (After C. Emery.)

tersegmental membranes. The third female is that of *Æ. congolensis*, and was described by Santschi in 1917 from a specimen taken in Gaboon with the cospecific worker. It has a greatly en-

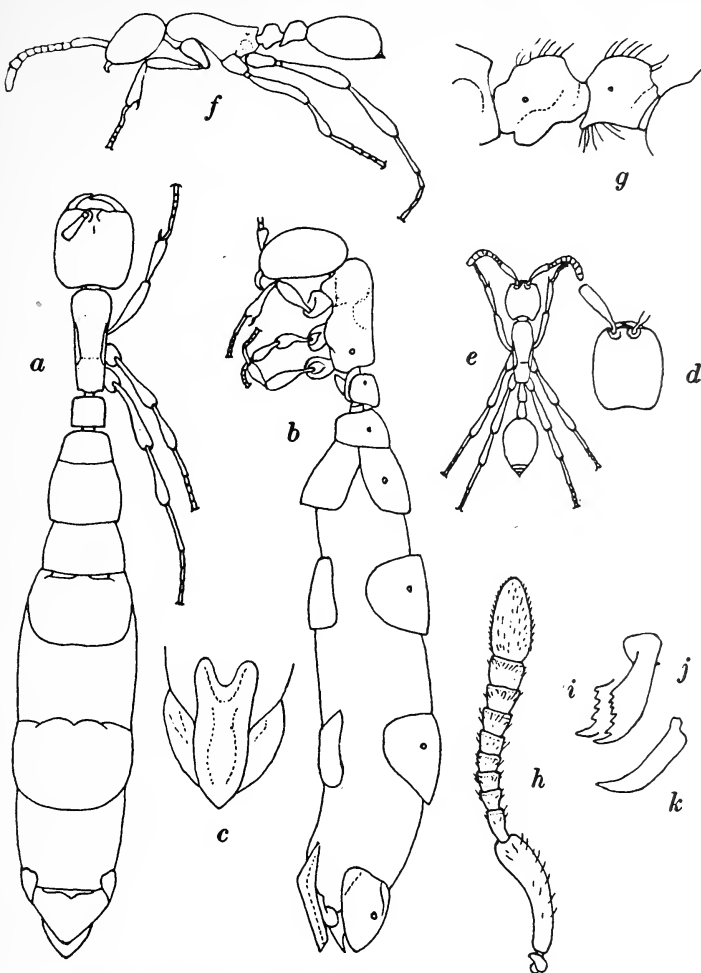


FIG. 2. *Aenictus congolensis* Santschi; a, female, dorsal view; b, same in profile; c, hypopygium of same; d, head of worker, dorsal view; e, worker, dorsal view, drawn to the same scale as a and b; f, worker more enlarged in profile; g, pedicel of same in profile; h, antenna of same; i, mandible of same; j, same of another worker specimen; k, mandible seen from above. (After F. Santschi.)

larged abdomen and was clearly in an active egg-laying condition when captured (Fig. 2). It measured 13.5–14 mm. and is of a deep reddish brown color like the worker, which measures only 2.4–3.4 mm. In structure this female resembles the two from North Africa but the head is as broad as long and has more rounded sides.

It happens that the workers of both *laviceps* and *martini* are closely related and belong to a group of species characterized by peculiar pale patches simulating large eyes at the posterior corners of the head. In Forel's and Bingham's dichotomic tables of *Ænictus* workers these species and their allies are first separated off by this character as most readily identifiable among the mass of species. Indeed, the first *Ænictus* worker to be described by F. Smith in 1858 belonged to this group and was no other than *laviceps* from Borneo, though he made it the type of his genus *Typhlatta*. Unfortunately the genus *Ænictus* was based by Shuckard (1840) on the male of *Æ. ambiguus* from Hindustan, and this is one of the many species of which the worker is still unknown. Since, therefore, we are unable to give a precise characterization of two of the three castes of the type species of *Ænictus sens. str.*, we are at present debarred from a thoroughgoing subdivision of the genus into subgenera. All we are able to do is to resuscitate Smith's name *Typhlatta* as that of a single subgenus and to assign to it the above-mentioned group of species with workers characterized by the pale coloration of the posterior corners of the head and females like those described below for *laviceps* and *martini*. The following table may serve to differentiate the workers of the various known forms of *Typhlatta*, all of which are closely interrelated and confined to the Indomalayan Region:—

WORKERS OF *ÆNICTUS* OF THE SUBGENUS *TYPHLATA*

- | | |
|---|---------------------------------|
| 1. Pale patches at the posterior corners of the head on distinct, elongate oval, tubercle-like elevations | 2 |
| Pale patches not on such elevations | 3 |
| 2. Head narrow; base of epinotum subopaque, longitudinally rugose-punctate throughout | <i>martini</i> Forel |
| Head broader and more convex beneath; base of epinotum smooth and shining above | <i>luzoni</i> Wheeler & Chapman |

3. Entire thorax and petiole finely and densely punctate4
At least the pronotum smooth and shining5
4. Pronotum feebly shining*binghami* Forel
Pronotum more densely punctate and opaque like the remainder of the
thoraxvar. *gatesi* Wheeler
5. Head oval, narrowed and rounded behind, with convex sides and with-
out a posterior border distinct from the occipital, or articular border,
which is narrower than the anterior border6
Head more oval-rectangular, with distinct posterior corners and the
posterior as broad or nearly as broad as the anterior border8
6. Petiole reticulate, armed beneath with a well-developed spine; post-
petiole broader than the petiole7
Petiole smooth, unarmed beneath; postpetiole not broader than the
petiole*gracilis* Emery
7. Base of epinotum feebly convex in profile, forming a right or obtuse
angle with the short declivity*laeviceps* F. Smith
Base of epinotum horizontal, forming an acute angle with the declivity,
which is longervar. *smythiesi* Forel
8. Petiole armed beneath with a transparent spine; epinotal angle pro-
nounced9
Petiole armed beneath with a truncated, dependent, transparent lamina;
epinotal angle more rounded*alticola* sp. nov.
9. Thorax scarcely impressed in profile in the mesoëpinotal region; petiole
without a spine beneath*elongatus* Karawaiew
Thorax with distinct mesoëpinotal impression; petiole armed with a
spine beneath10
10. Head very distinctly longer than broad11
Head scarcely longer than broad.

fergusoni Forel var. *breviceps* Forel
11. Epinotal angle distinctly rounded.

fergusoni var. *karawaiewi* Wheeler and Chapman

Epinotal angle pronounced12
12. Petiolar and postpetiolar nodes as broad as long, smooth and shin-
ing13
At least the petiolar node longer than broad14
13. Base of epinotum distinctly convex, densely sculptured through-
out*fergusoni* Forel (typical)
Base of epinotum sloping upward posteriorly, its anterior two-thirds
smooth and shiningvar. *hodgsoni* Forel
14. Slightly smaller than the two preceding forms; both nodes of the
pedicel longer than broadvar. *piltzi* Forel
Slightly larger than the typical *fergusoni*; petiolar node slightly longer
than broad, densely reticulatevar. *montanus* Forel

Ænictus (Typhlatta) læviceps F. Smith.

(Fig. 3)

FEMALE (undescribed). Length 8.5 mm.

Head large, convex above and below, decidedly broader than long, broader in front than behind, with very convex cheeks and broadly rounded posterior corners, divided by a deep median groove extending from the very small,

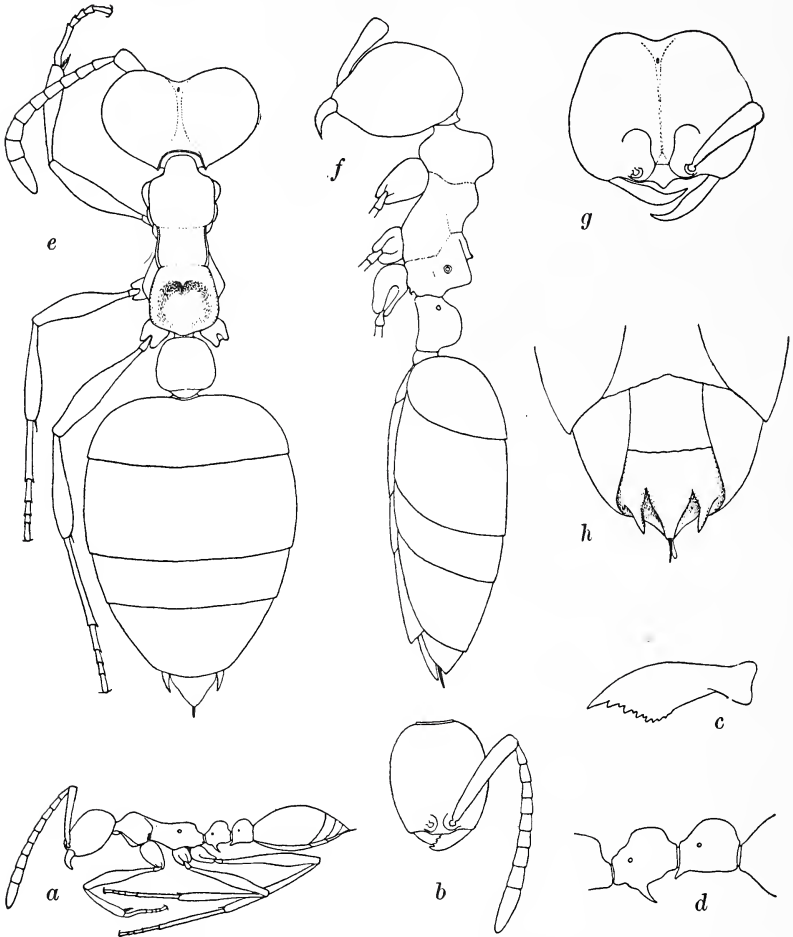


FIG. 3. *Ænictus læviceps* F. Smith. a, worker in profile; b, head of same, dorsal view; c, mandible; d, pedicel of same, in profile; e, female, dorsal view, drawn to same scale as the worker (a); f, female in profile; g, head of same, dorsal view; h, tip of abdomen of same, ventral view, showing hypopygium.

triangular frontal area to a point where it bifurcates just in front of the strongly marginate occipital border. Antennal foveæ large and deeply impressed. Genal carinæ indistinct. Visual organs represented only by a minute ocellus in the frontal groove. Clypeus very short, its anterior border straight on each side, in the middle flattened and projecting as a blunt triangular point. Mandibles less than half as long as the head, subfalcate, slender, broadest in the middle, with pointed tips and microscopically denticulate apical borders. Scapes about half as long as the head, slender at the base, gradually widening apically; funiculi only slightly thickened towards their tips, the first joint twice, the second to sixth fully one and one-half times as long as broad, the seventh and eighth shorter but longer than broad, together as long as the somewhat pointed terminal joint. Thorax stout but much narrower than the head, broad through the pro- and epinotum, narrowed and laterally constricted in the mesoëpinotal region, without promesonotal and mesoëpinotal sutures though their positions are indicated by impressed lines. Pronotum broader than long, its dorsal portion high and subcuboidal, flattened in the middle with steeply sloping anterior and posterior surfaces, the anterior angles convex and swollen, visible in dorsal view as a rounded projection on each side of the subcuboidal dorsal portion. Mesonotum shorter than the pronotum, concave on each side, in profile with a strong dorsal convexity and concave, sloping posterior surface. Epinotum broader than the pronotum owing to a strong swelling on each side in the sternal region, the base subtrapezoidal, somewhat broader and more rounded behind than in front, with a deep concavity in the center. The anterior portion of the base is more convex and projects into the concavity as a small, central, pointed tooth. In profile this dentate surface slopes upward and backward. The border of the larger, posterior concave portion has a similar inclination and forms a right angle with the straight, flattened and perpendicular declivity. Seen from behind this surface is narrow below and broad above, with its dorsal border rather deeply and sinuately excised in the middle and the lateral angles prominent and somewhat rounded. Epinotal spiracles large and circular; metasternal angles with a small, acute, upturned tooth near the insertion of the hind coxa. Petiole from above nearly as long as broad, somewhat broader behind than in front, with rounded sides; the node in profile slightly flattened anteriorly and dorsally, more rounded behind, the ventral surface of the petiole feebly concave with scarcely an indication of a tooth at its anterior end. Gaster large and broad, subtriangular, rounded anteriorly, tapering to a point behind, strongly compressed dorsoventrally, with the first and especially the third segment decidedly shorter than the second and fourth. Pygidium small, triangular, with subtruncate tip; hypopygium with a raised triangular median portion and a stout, slightly curved tooth on each side. Sting small. Legs rather long and slender; the femora and tibiæ slender at the base and clavate.

Smooth and shining; mandibles sparsely and indistinctly punctate. Gaster covered uniformly with coarse, transverse, piligerous punctures,

except the median portion of the first segment and a large median, triangular area at the base of the fourth segment, which are very smooth and shining. Pygidium very finely shagreened. Scapes and legs with small, sparse, piligerous punctures.

Hairs pale yellow, rather long, sparse, slender, flexuous, and pointed on the coxæ, legs, scapes, mandibles and clypeus, absent on the head, thorax and petiole, with the exception of four hairs on the front; gaster, excepting the two very smooth areas above mentioned, invested uniformly with short, obtuse, stiff, oblique, glistening hairs.

Black; mandibles, clypeus, funiculi and pygidium red; hypopygium dark brown; scapes and legs, including the coxæ, ivory yellow; bases of coxæ reddish, their tips, the trochanters, the tips of the femora and basal half of each tibia dark brown. Head, thorax and gaster with the following brownish ivory-yellow maculation: a large transverse spot near the middle of each side of the head, representing the yellowish or reddish spot of the worker, but more anterior; a quadrangular spot, divided longitudinally by a median brown line, covering the disc of the pronotum; another on the base of the epinotum behind its anterior dentate surface; a large reniform spot, emarginate behind, on the dorsal surface of the petiolar node; an arcuate spot apparently composed of four confluent circular spots at the base of the first gastric segment and a pair of small transverse and less sharply defined spots more posteriorly on the same segment; second segment with two pairs of transverse and more laterally situated spots, the anterior pair at the anterior border of the segment; third and fourth segments each with a single pair of similar markings. The borders of the various segments, both dorsally and ventrally, are also distinctly yellowish, the median surface of the venter reddish, and the front of the head with a tinge of the same color.

Described from a single specimen taken by Dr. Chapman on May 23, 1923, from a colony that had been making raids for two days on other ants and miscellaneous insects near his camp in the mountains back of Dumaguete. This colony finally bivouacked under an overhanging rock and when a fire was built very near it and it again began to migrate, the female, many workers, much brood and a number of ænietophiles were captured. The contracted and strongly overlapping segments of the gaster of the female indicate that she was not in an actively egg-laying condition, and the many hundreds of workers and full-grown larvæ in the colony indicate that she must be either its old and exhausted mother or a young substitute queen that had not yet entered on her period of great fecundity. Her fresh and unabraded appearance would seem to argue in favor of the latter supposition.

Many of the workers belonging to this colony differ from those taken by Dr. Chapman from ten other colonies in the same locality in having a smooth, shining area on the base of the epinotum. Since this character is not constant I merely call attention to it as an incipient variety without giving it a name. All the specimens taken about Dumaguete are slightly larger and darker than series of *laviceps* in my collection from Luzon Island (F. X. Williams), Java (K. Dammerman) and Borneo (Hewitt and Brooks).

***Aenictus (Typhlatta) martini* Forel.**

(Fig. 4)

FEMALE (undescribed). Length 6.5 mm.

Head much like that of the female *laviceps*, but narrower, though distinctly broader than long, with less convex cheeks, only slightly broader in front than behind, also deeply divided by a longitudinal groove, which, however, disappears before reaching the strongly marginate occipital border. There are no traces of ocelli. Antennal foveæ deep. Clypeus as in *laviceps*, but the median projection of its anterior border much less pronounced. Mandibles somewhat shorter and stouter but of the same configuration. Antennæ similar, the scapes somewhat more rapidly enlarged and more cylindrical at their tips; the several funicular joints of about the same lengths. Thorax much simpler; narrower than the head and both dorsally and laterally constricted at the mesonotum. Pronotum about one and one-third times as long as broad, elliptical, with evenly convex and rounded dorsal and lateral surfaces, the inferior angles scarcely swollen. Mesonotum short, broader than long, sloping to a rather deep and acute transverse impression representing the mesoepinotal suture. Epinotum broader than the pronotum, subrectangular and as broad as long, in profile evenly convex and rounded, without differentiated basal and declivous surfaces. Epinotal spiracles large, circular, impressed. Metasterna swollen anteriorly, the metasternal angles above the insertion of the hind coxæ with a very minute denticle. Petiole subquadrate, as broad as long, scarcely broader behind than in front, in profile with low evenly rounded node, the ventral surface nearly straight, unarmed. Gaster very similar to that of *laviceps*, but the first segment is less transverse anteriorly and more narrowed and constricted at the petiolar articulation. Pygidium shorter and more truncated at the tip; hypopygium with much shorter and smaller lateral teeth and its median raised area flattened, elongate, with subparallel borders. Sting well-developed. Legs rather long; femora and tibiæ clavate.

Smooth and shining, the whole body covered with sparse, piligerous punctures, which are most distinct on the dorsal surface of the thorax, petiole and gaster where they are raised above the general surface so that the hairs appear to arise from very minute tubercles.

Hairs glistening white, abundant, erect or suberect, long, curved, of uneven length on the head, thorax, legs and scapes, more uniform, and somewhat shorter on the gaster, which they cover, except for a smooth area around the insertion of the petiole and a median smooth area on the middle of the fourth segment. Even the funiculi have long, though oblique, hairs. Those on the middle of the gaster and the dorsal surface of the head, thorax and petiole are flattened, with long, slender tips, and are black with white bases and tips. The hairs on the appendages are more delicate and of the usual structure.

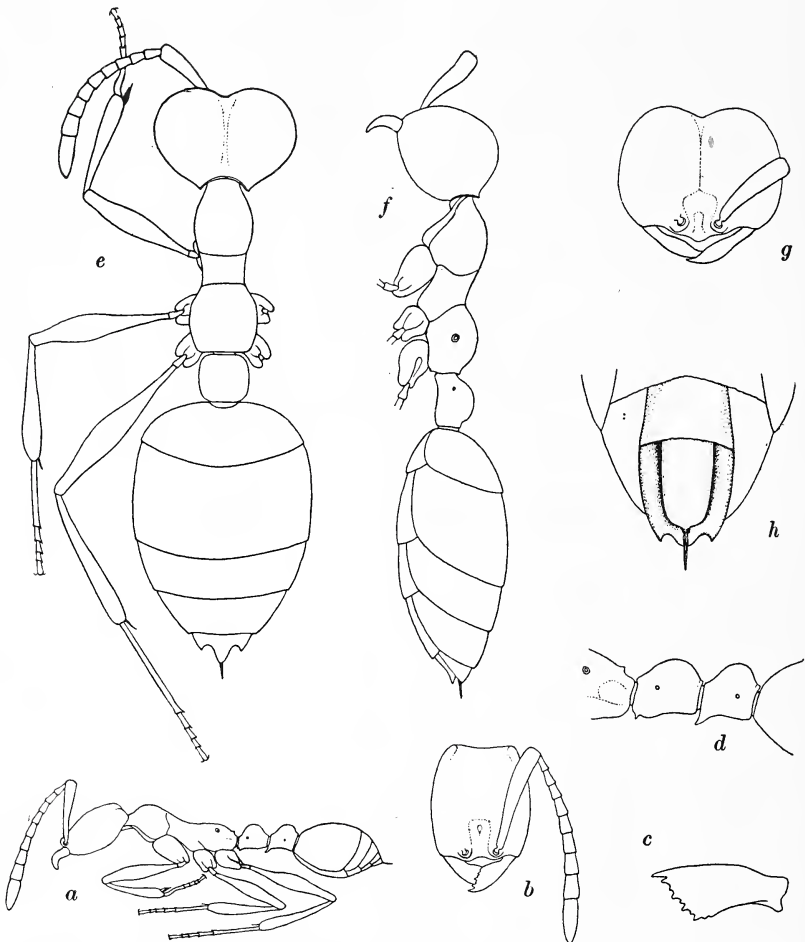


FIG. 4. *Enictus martini* Forel. *a*, worker in profile; *b*, head of same, dorsal view; *c*, mandible; *d*, pedicel; *e*, female, dorsal view, drawn to same scale as worker (*a*); *f*, female, in profile; *g*, head of same, dorsal view; *h*, tip of abdomen, ventral view, showing hypopygium.

Black; mandibles, clypeus, cheeks, gula and large spots at the posterior corners of the head and representing the ivory yellow spots of the worker, the sides of the pronotum, the coxæ, femora and tibiæ castaneous; tarsi, funiculi and tips of tibiæ and scapes paler and more reddish. Borders of gastric segments both dorsally and ventrally, pygidium and hypopygium broadly yellowish brown, with golden reflections.

Described from a single specimen taken by Dr. Chapman on January 3, 1926, as she was being dragged by her workers over a banana leaf lying on the ground, after the colony had been stirred up and induced to migrate from its temporary quarters in a great pile of earthworm castings. As shown by the contracted gaster, the insect is in the same non-reproductive phase as the *laviceps* female described above. The colony from which this *martini* female was taken contained no larvæ. Another queen of this species was captured by Dr. Chapman on April 4, 1924, in the same locality in a bivouacking colony, but was left in the Philippines.

The collections received from Dr. Chapman contain numerous workers of *martini* from twenty different colonies and exhibit some variation in size and coloration, the body being brownish-red instead of black in some cases, but both forms may occur in the same colony, so that the paler individuals may be either nest variations or due to immaturity.

Aenictus (Typhlatta) alticola Wheeler and Chapman sp. nov.

(Fig. 5, a-d)

WORKER. Length 4-4.5 mm.

Distinctly larger and stouter than *laviceps* for which it may be readily mistaken, but head as broad behind as in front, with distinct though nontuberculate and rounded posterior corners, the posterior border with a slight though distinct convexity in the middle, the occipital border marginate. Anterior clypeal border straight and transverse in the middle, bearing a series of about six minute denticles. Mandibles triangular, with oblique apical borders, with a strong apical tooth and five unequal, widely spaced basal denticles. Antennal scapes not reaching the posterior border of the head, gradually enlarged and only slightly flattened at their tips; funiculi much as in *laviceps*, first joint slightly longer than the second. Thorax differing in having the epinotal angle more obtusely rounded. Petiole with a distinctly more convex and rounded node in profile, armed anteroventrally with a dependent, transparent, truncated lamina instead of a spine. Postpetiole as in *laviceps*, with a small, acute, forwardly directed tooth at its anteroventral border.

Sculpture and pilosity much as in *laviceps*, but the meso- and epinotum more shining, owing to the less pronounced punctuation. Petiole smooth and shining. Pilosity as in *laviceps*, but the hairs on the legs somewhat more numerous, especially on the scapes and femora. Color also as in *laviceps*, with the light patches on the sides of the head brownish ivory yellow, rather small and somewhat nearer the posterior corners.

Described from numerous workers taken by Dr. Chapman from a single large colony found raiding in Polis Pass, Bontoc, Luzon, at an altitude of 6,000 feet.

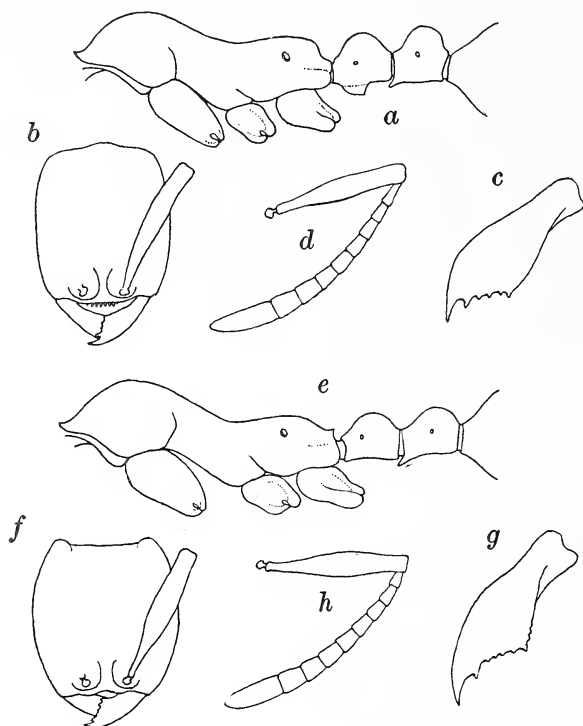


FIG. 5. *a*, worker *Ænictus alticola* sp. nov.; thorax and pedicel in profile; *b*, head, dorsal view; *c*, mandible; *d*, antenna; *e*, worker *Ænictus luzoni* Wheeler and Chapman, thorax and pedicel in profile; *f*, head, dorsal view; *g*, mandible; *h*, antenna.

***Ænictus* (*Typhlatta*) *luzoni* Wheeler and Chapman**

(Fig. 5, e-h)

WORKER. Length 4-4.5 mm.

The following remarks may be added to the previously published description: Resembling the worker of *martini* Forel in

having the posterior corners of the head distinctly tuberculate, but the stature is larger and the head is decidedly broader, flattened above, with much more convex sides and the posterior border transverse and nearly straight between the projecting posterior corners. The mandibles have a distinct denticulate angle between the basal and apical borders; the latter with a strong terminal tooth, a much smaller subterminal tooth and several thinly set basal denticles. Funicular joints 1 and 2 subequal, 7 and 8 scarcely longer than broad, the terminal joint longer than the two penultimate subequal joints together. Thorax very similar to that of *martini* but the saddle-like impression of the mesonotum is somewhat deeper. Petiole unarmed beneath, the postpetiole with a small, anteriorly directed tooth near the articulation with the petiole.

Sculpture, pilosity and color very much as in *martini*, but the base of the epinotum is conspicuously smooth and shining. The mesonotum and mesopleuræ are also more shining, more distinctly longitudinally rugulose and less punctate. The ivory yellow spots on the tuberculate posterior corners of the head are more extensive, covering nearly half of its sides. Funiculi, tarsi and articulations of legs paler and more reddish.

The types of this species are from Illicos, Norte Province, Luzon. Dr. Chapman has now secured numerous specimens from two colonies at Dumaguete, on Negros Island.

The following Philippine forms, which must be left provisionally in the subgenus *Ænictus sens. str.*, may be readily separated by means of the following key:

1. Head and thorax blackish or dark brown, opaque and densely sculptured2
 Head and pronotum smooth and shining; color yellow or yellowish red3
2. Pedicel, gaster and appendages brown. Length 2.8-3 mm.
 aratus Forel subsp. *nesiotis* subsp. nov.
 Pedicel, gaster and appendages reddish. Length 2.5-2.8 mm.
 var. *fraterculus* var. nov.
3. Thorax distinctly impressed in the mesoëpinotal region. Length at least 2.5 mm.4
 Thorax not impressed in the mesoëpinotal region. Length 1.6 mm.
 piercei sp. nov.

4. Slender species; head subelliptical, distinctly longer than broad; antennal scapes reaching beyond the posterior border of the head; petiole with a round ventral swelling; femora and tibiae not incrassated.

camposi Wheeler & Chapman

More robust species; head subrectangular, scarcely longer than broad; antennal scapes not reaching beyond the posterior border of the head; petiole with a transparent, truncated ventral lamella; femora and tibiae incrassated *powersi* sp. nov.

Ænictus (*Ænictus*) *aratus* Forel subsp. *nesiotis* Wheeler and Chapman, subsp. nov.

(Fig. 7, a-d)

WORKER. This form, which we formerly referred to the typical *aratus*, proves to be distinct. It is only 2.8-3 mm. long and is therefore perceptibly smaller than the type which measures 3.3-3.5 mm. The thorax is

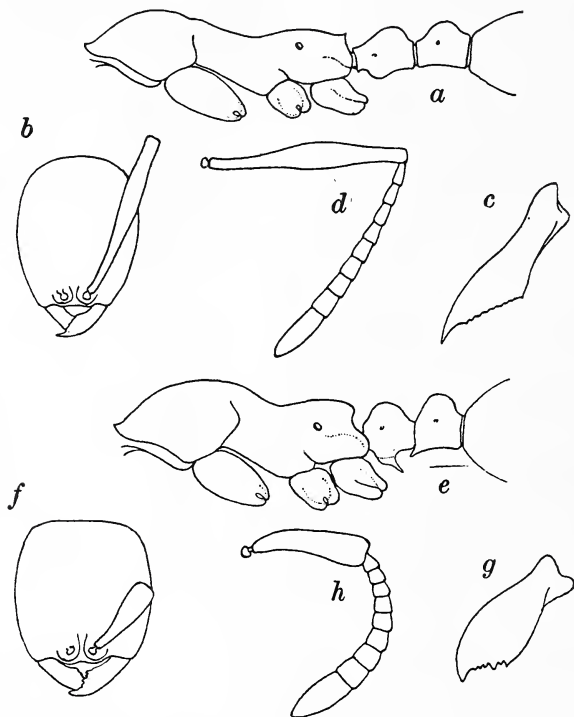


FIG. 6. a, worker *Ænictus camposi* Wheeler and Chapman, thorax and pedicel in profile; b, head, dorsal view; c, mandible; d, antenna; e, worker *Ænictus powersi* sp. nov., thorax and pedicel in profile; f, head, dorsal view; g, mandible; h, antenna.

even less impressed in the mesoëpinotal region so that the dorsal outline in profile is very nearly straight. The pedicel is somewhat more slender. The head, thorax and pedicel are more opaque and the thorax both dorsally and ventrally is more coarsely longitudinally rugose. The color is also decidedly darker, the head and thorax being black or brownish black, instead of reddish brown and the gula, pedicel, gaster and appendages are also darker and less reddish, the greater portion of the first gastric segment being concolorous with the head and thorax.

Numerous specimens from three colonies found at Dumaguete. One of these, with numerous larvæ was nesting in a brush-pile; another, also with brood, was occupying earthworm burrows.

Ænictus (Ænictus) aratus subsp. *nesiotis* var. *fraterculus* Wheeler and Chapman, var. nov.

WORKER. Length 2.5-2.8 mm.

Averaging smaller than the preceding form, and differing in color, the pedicel, gaster and appendages being brownish red and contrasting with the blackish brown head and thorax. Tarsi and borders of gastric segments yellowish. Mandibles and in some specimens also the anterior portion of the head, more or less reddish brown.

Numerous specimens from a single colony taken at Dumaguete.

Ænictus camposi Wheeler and Chapman

(Fig. 6, a-d)

A number of workers taken at Dumaguete from a small colony that was foraging in the open on the ground.

This form is very closely related to *Æ. wroughtoni* Forel, of India, but differs in having the epinotal declivity marginate on the sides and above and in having the mesopleuræ and epinotum subopaque and finely and densely punctate, instead of smooth and shining. Perhaps *camposi* should be regarded as a subspecies of *wroughtoni*.

Ænictus (Ænictus) piercei Wheeler and Chapman, sp. nov.

(Fig. 7, e-g)

WORKER. Length 1.6 mm.

Distinctly smaller than *Æ. javanus*, which it resembles in form, sculpture and coloration. Head not longer than broad, with more rounded sides and without produced posterior corners, with straight instead of concave posterior border. Antennæ short, funiculi reaching only to the middle of the head, funicular joints 2-6 transverse, much shorter than in *javanus*.

Dorsal outline of thorax in profile even more nearly straight and continuous, with the epinotum forming a rounded instead of an acute rectangle. Petiole and postpetiole distinctly broader in proportion to their length. Femora and tibiæ more incrassated.

Smooth and shining, with fine, sparse piligerous punctures, mesopleuræ, epinotum, sides and ventral portions of petiole and postpetiole, subopaque, finely and densely punctate.

Pilosity white, uneven, sparse on the upper surface of the body, shorter on the appendages.

Yellow; head, thorax and pedicel more reddish but decidedly paler than in *javanus*; anterior border of head and mandibles slightly brownish.

Described from two specimens taken by Dr. W. D. Pierce at Cadiz, P. I. This species is also clearly different from *Æ. brevicornis* Mayr and *ceylonicus* Mayr.

Ænictus (*Ænictus*) *powersi* Wheeler and Chapman, sp. nov.

(Fig. 6, e-h)

WORKER. Length 2.5-3 mm.

Head scarcely longer than broad, subrectangular, nearly as broad behind as in front, with feebly rounded sides and straight posterior border, the posterior corners rounded, not produced. Frontal and genal carinæ very short, the latter not dentate. Clypeus concave, with narrow, translucent anterior border, subtriangular, with a large blunt apical tooth and several minute, irregular basal denticles on the terminal border, the external border convex. Antennæ short, the scapes thickened apically, reaching to the posterior third of the head, first funicular joint small, as long as broad, joints 2-8 slightly broader than long, terminal joint a little longer than the two penultimate joints together. Pronotum slightly flattened above, the mesonotum short, sloping to the mesoëpinotal constriction, which is moderately pronounced. Epinotum with convex base and concave declivity, the boundary between the two developed as a blunt point. Petiole nearly as broad as long, its node evenly rounded and hemispherical, the ventral surface with a transparent lamina, produced behind as a downwardly and backwardly directed spine. Postpetiolar node resembling the petiolar node but somewhat broader and slightly broader than long, anteroventrally with a well developed tooth, which is directed downward and forward. Gaster regularly elliptical. Legs with incrassated femora and tibiæ.

Mandibles opaque, finely and densely shagreened. Remainder of body smooth and shining, with fine, sparse, piligerous punctures, except the mesopleuræ, mesoëpinotal constriction, sides of epinotum and ventral surfaces of the petiole and postpetiole, which are subopaque, finely and densely punctate.

Hairs white, uneven, rather delicate, sparse on the body, short on the appendages.

Mandibles, antennal foveæ and anterior border of head reddish brown, remainder of head, antennal scapes and thorax yellowish red; pedicel, gaster and legs, including the coxæ, yellow; antennal funiculi brown, except the terminal joint, which is yellowish red like the scapes.

Described from several workers taken near Dumaguete at an altitude of 1,800 feet from a single colony under a piece of wood in a garden. This species is hypogæic.

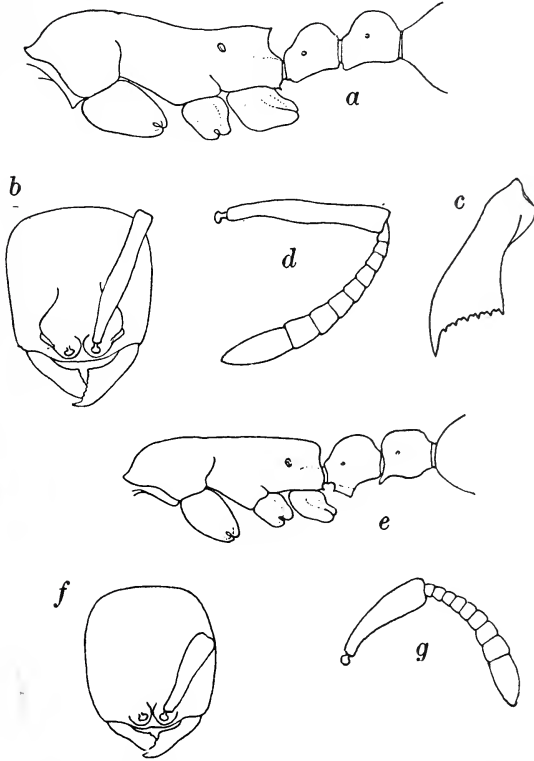


FIG. 7. *a*, worker *Aenictus aratus* Forel subsp. *nesiotis* subsp. nov., thorax and pedicel in profile; *b*, head, dorsal view; *c*, mandible; *d*, antenna; *e*, worker *Aenictus piercei* sp. nov., thorax and pedicel in profile; *f*, head, dorsal view; *g*, antenna.

Dr. Chapman has also secured several isolated males of *Aenictus* at lights. All or some of these specimens are probably the unknown males of the above recorded species. Before describing them, it seems best to await the results of his observa-

tions on *Ænietus* colonies during his coming sojourn in the Philippines.

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PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY

MEETING OF OCTOBER 15, 1929

A regular meeting of the New York Entomological Society was held at 8:00 P. M., on October 15, 1929, in the American Museum of Natural History; President Wm. T. Davis in the chair, with fifteen members and five visitors present.

Notices were given of the meeting on November 21, of Economic Entomologists, of the new Cassino Directory, and of the publication of the letters of E. A. Schwarz.

In a discussion on insect behavior, Mr. Schwarz told of a brood of scorpions born in the museum which lived on the back of the mother and were in part devoured by her.

Mr. Ragot added some similar information from observations made in Mexico; and Mr. Curran suggested that those eaten might have been dying.

Some experiences with mantis were given by Mr. Ragot and Mr. Davis. Mr. Marks remarked on their eyes being apparently of little use; Mr. Bromley spoke of the short distance insect sight may carry, and Mr. Davis mentioned longhorn grasshoppers depending on antennal information.

Mr. Burke spoke of his collections of Odonata, particularly of *Libellula axilina* and *L. vibrans*.

Mr. Davis exhibited some interesting roaches with his observations on the imperfect ootheca in *Panchlora cubensis* which will be printed in full.

Mr. Sherman spoke of *Allorhina nitida* used as toys by children at Norfolk.

Mr. Barber spoke of the European *Mantis religiosa* introduced at Rochester, N. Y., and found also by Mr. Burns on Long Island.

Mr. Chapin spoke of flies depositing eggs on a sick dog, the attraction being possibly, as suggested by Mr. Curran, the dirt.

After a general discussion on such oviposition the Society adjourned.

MEETING OF NOVEMBER 19, 1929

A regular meeting of the New York Entomological Society was held at 8:00 P. M., on November 19, 1929, in the American Museum of Natural History; President Wm. T. Davis in the chair, with twenty-five members and seventeen visitors present.

Mr. Davis Marks, of 25 West 68th Street, was elected a member.

Dr. Lutz, with lantern slide illustration, spoke of his "Observations on Leaf-Cutting Ants in Panama." His remarks have been printed in full in "Novitates."

Mr. P. J. Darlington, of Boston, present as a visitor, exhibited by lantern slides the localities in which he had made collections in South America.

He showed the region near Santa Marta in Columbia where a mountain range extends into the Peninsula of Guajira and carries the coast-line further north than Panama. There he found desert with cactus, fresh-water swamps and dense forests penetrated by mountain torrents. During the dry season the bed of these mountain waters courses furnished good collecting. Continuing his description of this part of South America he showed mountain scenes up to a tree line at 11,000 ft. and even beyond it to summits at 15,000 feet or over, presenting an interesting picture of a region still little known though visited by early Spanish explorers.

Mr. Davis exhibited a melanistic example of the Carolina grasshopper, found by Mr. Angell at Englewood, N. J., as well as a number of the usual form of the species.

MEETING OF DECEMBER 3, 1929

A regular meeting of the New York Entomological Society was held at 8:00 P. M., on December 3, 1929, in the American Museum of Natural History; President Wm. T. Davis in the chair, with twenty members and fifteen visitors present.

Mr. George De Ghika, 25 Broadway, New York City, and Mr. Herman Moennich, Little Neck, N. Y., were elected members of the Society.

Mr. Davis exhibited the recent book on Mosquitoes by Robert Matheson.

Mr. Huntington spoke on "A Trip to Lesser Antilles and Trinidad," with illustration by lantern slides from photographs made by his companion, Mr. Robert Brown.

The trip, which occupied six weeks in all, of which three weeks were spent on Trinidad, resulted in finding there thirty-six species of *Lycanida* and ninety species of *Hesperida*. Of the latter twenty species were not listed by Kaye and nine are still unidentified. With the help of a number of lantern slides Mr. Huntington showed many features of the Lesser Antilles, including St. Thomas, St. Croix, St. Kitts, Nevis, Antigua, Guadeloupe, Dominica, Martinique, St. Lucia and Barbadoes. In Trinidad the pitch lake and the commercial operations there conducted were shown.

Mr. Huntington's descriptions of the pools of the pitch lake in Trinidad brought forth a comment by Mr. Curran on the fish found in them, and a discussion in which Mr. Huntington took part, of the manner in which the fish reached such situations.

Mr. Davis showed five species of cicadas from Barro Colorado Island in the Canal Zone, collected by Prof. George C. Wheeler, Howard H. Cleaves and C. H. Curran.

Mr. Curran said that cicadas were sufficiently abundant on the island but that there was great difficulty in getting near them in the woods.

Mr. Curran read a report on the insects collected at the station in Harri-man State Park. Of Diptera he said 540 species had been found, many new to the State List and thirty new to science. The report on the Lepidoptera was incomplete but the estimated total was about 1,100 species.

MEETING OF DECEMBER 17, 1929

A regular meeting of the New York Entomological Society was held at 8:00 P. M., on December 17, 1929, in the American Museum of Natural History; President Wm. T. Davis in the chair, with eighteen members and nine visitors present.

The president appointed as nominating committee Messrs. Barber, Sherman and Dr. Lutz.

The president announced the death of Mr. Notman's father; and change in the announced program thereby necessitated.

Mr. Engelhardt showed a portion of his collection of *Ægeriidae* pointing out that the scope of his investigations was an attempt to trace the life history of each species and its geographic races and varieties. As an example he showed the clear-wing moth inhabiting the clematis, *Alcathæ caudata*, and the varied forms it assumes in the Atlantic region and then westward and southward, known as *korites*, *pepsiodes*, *ferrugata* and *ver-rugo*. Then taking up the maple callus borer, *Synanthedon acerni*, and other species of that genus, he showed how by rearing the moths from pupæ found in known food plants, his data had been accumulated.

Dr. Hartzell spoke of his collections in Bermuda especially in *Cicadellidæ*. His remarks will later be printed in full.

Mr. Wm. T. Davis showed a box of dragon flies and stated that with the aid of the recently published "Handbook of the Dragon Flies of North America" several additions to the New York State List of Odonata had been detected in his collection. He said that he had in preparation a more complete list of additions, but gave the following as important:

Erythrodiplax minuscula Rambur. A southern species first detected on Staten Island by Mr. Joseph F. Burke during the summer of 1929. Several individuals were captured.

Pantala hymenea Say. Collected at Tottenville, Staten Island, July 12, 1925.

Tramea abdominalis Rambur. A southern species, a male of which was collected in the Clove Valley many years ago on the 21st of July.

Mr. Davis also exhibited a box of cicadas, containing a series of *cinctifera* Uhler from New Mexico, and specimens collected by Dr. Beamer at Eagle Pass, Texas, apparently related but not identical.

Mr. Mutchler exhibited the beetle *Gibbium psylliodes* and the white spherical cocoons made by its pupa. A more complete account will be published later by him.

Mr. Bromley spoke of the persistent character of the oviposition scars of the last brood and evidences of scars of seventeen and thirty-four years ago, their age being established by counting the annual rings. He spoke also of the abundance some years ago of the crepuscular dragon fly at a small lake in Massachusetts.

MEETING OF JANUARY 7, 1930

A regular meeting of the New York Entomological Society was held at 8:00 P. M., on January 21, 1930, in the American Museum of Natural

History; President Wm. T. Davis in the chair, with eighteen members and fifteen visitors present.

Mr. Barber, as chairman of nominating committee, moved the re-election of all officers. There being no other officers, they were re-elected.

Mr. Harold C. Hallock spoke with lantern slide illustration of "The Oriental Garden Beetle" (*Aserica castanea*) in America and its control. He showed how it first appeared on Long Island and its spread since into Connecticut, New Jersey, Pennsylvania and the District of Columbia, with the characters by which it is distinguished from allied species. The character of the injury and the plants attacked were discussed, together with the control methods including trapping which once yielded 21,000 specimens in a night. The application of arsenate of lead to the soil in which the larvæ work, as shown by the condition of the vegetation thereon, had proved somewhat effective. The volunteer work of birds was also helpful in reducing the number of larvæ.

Mr. Hallock's remarks were discussed by Messrs. Bromley, Barber, Mutchler, Davis and Dr. Leonard, especially in reference to the tendency of natural enemies and disease to overcome injurious insects in time. Several of the experienced economic entomologists thought this might be true of native insects, but not apparent in such introduced pests as the cotton boll weevil.

Mr. Davis gave some instances, as the bag worm and the Catalpa sphinx, where the parasites had caught up with the pest.

Mr. Angell closed the meeting by an exhibition of an artificial insect group from China.

MEETING OF JANUARY 21, 1930

A regular meeting of the New York Entomological Society was held at 8:00 P. M., on January 21, 1930, in the American Museum of Natural History; President Wm. T. Davis in the chair, with fifteen members and three visitors present.

Mr. C. Wm. Wurster, 104 Fifth Avenue, New York, and Mr. Leon Vanderlen, 82 Washington Place, New York, were elected members of the Society.

Mr. Howard Notman made an address, illustrated by lantern slides, entitled "Another Transcontinental Collecting Trip." Entirely alone, Mr. Notman traveled in his auto through the southern and western states to the Pacific coast, returning by a different route to his summer home in the Adirondacks. About fifty locations, some in the coastal plain of the southern states, some at elevations of 1,100 feet in the Rockies or Sierra Nevada, others on the forested banks of rivers, or again in deserts or beside saline pools, were searched for fluviatile beetles. Once 700 beetles were caught in one day, and many thousands were caught on the trip, principally in the families *Carabidæ*, *Hydrophilidæ*, *Staphylinidæ*, *Heteroceræ*, and *Anthicidæ*. The genus *Bembidion*, which was the particular object of Mr. Notman's search, was represented by a large number of species; occasionally some species of *Ochthebius* or of *Heterocerus* were found in abundance.

In collecting so assiduously in variations of the river bank environment Mr. Notman made some interesting observations. Where there was a choice between sunlight and shade, the beetles, especially those feebly chitinized, always preferred the shade. In collecting along shores recently flooded it was found that most of the beetles had been driven away; while the river was rising, the collecting was good along the edge of the rising waters; but as the waters receded leaving banks covered with mud, the beetles were slow to return. *Heterocer* seemed to come first, the *Scaritini* last. Mr. Notman also remarked upon the scarcity of carabid larvæ in places where the adults were abundant, though the larvæ of some other families, *Heteroceridæ* and *Staphylindæ*, for instance, were plentiful.

MEETING OF FEBRUARY 4, 1930

A regular meeting of the New York Entomological Society was held at 8:00 P. M., on February 4, 1930, at the American Museum of Natural History; President Wm. T. Davis in the chair, and eighteen members and three visitors present.

In the absence of Mr. Leng, Miss Sherman was appointed Secretary pro tem.

The treasurer presented the annual report for 1929, duly audited.

The President called the attention of those present to the fact that the Committees for 1930 were the same as for 1929.

The speaker of the evening, Mr. Robert J. Sim, of Moorestown, N. J., then gave his paper on "Observations on Unrecorded or little Known Species of *Scarabæidæ* of New Jersey." He discussed twenty-two species, chiefly of the genera *Onthophagus*, *Aphodius*, *Odontæus* and *Serica*, not recorded in the Smith 1909 Catalogue. Mr. Sim's paper will appear in the Journal of the Society.

Mr. Bromley mentioned the occurrence in Missouri of a species of *Odon-tæus*, which flew with a buzzing sound at twilight, close to the ground.

Mr. Davis exhibited two specimens of *Polistes pallipes*, one taken as it was eating a live grasshopper which it had caught; the other, as it was eating into the head of a live Cicada. Mr. Davis stated that it is usual for *Polistes* wasps to seize soft buried caterpillars, etc., as their prey, but that on July 16, 1929, while at Old Place, Staten Island, he had seen a *Polistes pallipes* capture a small *Melanoplus* grasshopper, the body of which was 7 mm. in length. This of course was quite a tender individual owing to its small size. He exhibited the specimens and also referred to the Journal for June, 1924, where there is an account of a *Polistes* found eating a living *Cicada hieroglyphica* at Willard, Missouri, by Mr. A. E. Brower.

Mr. Curran exhibited a specimen of *Chionea*, a genus of apterous snow-flies, of the family *Tipulidæ*, mentioning that these flies, which are spider-like in appearance, are active only on the snow and ice in a low temperature and assume an attitude of death in warmer places. Their life history is unknown. Locality: Interstate Palisades Park, N. Y.

MEETING OF FEBRUARY 18, 1930

A regular meeting of the New York Entomological Society was held at 8:00 P. M., on February 18, 1930, in the American Museum of Natural History; President Wm. T. Davis in the chair, with nineteen members and thirteen visitors present.

Dr. Lutz read a paper, "Brief Notes on the Case-Making Instinct of Caddis-Fly Larvæ," which will be printed in full.

Mr. Nicolay spoke on "Beetling in Nova Scotia," illustrating his remarks by specimens and photographs. In August, 1929, he and Mrs. Nicolay had visited Lake Kedgemakooage, reaching their destination via Yarmouth and Annapolis Royal, thirty-five miles south of which the lake and its camps are situated. The Carabidæ were the predominant beetles; among those shown were *Bembidian umbraticum*, *Platynus metallescens*, *Lebia canonica*, *Apristus cordicollis*, and *Cicindela 12-guttata*. In *Buprestidæ*, *Chrysobothris verdigripennis* and *Melanophila fulvoguttata* were especially noted. The region traversed in reaching the lake was level and, for much of the distance, well cultivated. Mr. Nicolay commented on the absence of *Cydrini*, *Lycaenidæ* and *Hesperidæ*, and the unnecessary number of bulls, which led to several members recalling experiences with those animals.

Mr. Nicolay also recorded finding *Casnonia ludoviciana* on October 19, in a swamp near the Hudson River at Piermont, N. Y.

The president announced the sailing, on February 13, of Mr. C. L. Pollars to Iquitos, Peru, via Para, to collect *Morphos* for Mr. Frank Johnson.

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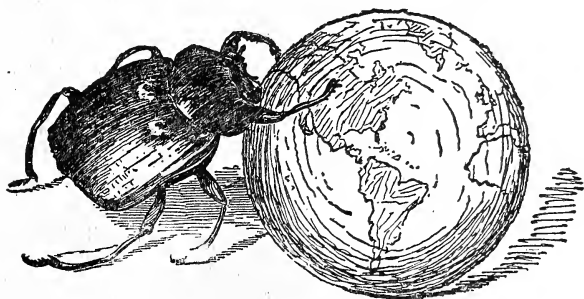
SEPTEMBER, 1930

No. 3

JOURNAL
OF THE
NEW YORK
ENTOMOLOGICAL SOCIETY



Devoted to Entomology in General



SEPTEMBER, 1930

Edited by HARRY B. WEISS

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VOL. XXXVIII

SEPTEMBER, 1930

No. 3

CORRODENTIA OF THE UNITED STATES OF AMERICA: I. SUBORDER ISOTECNOMERA

BY PAUL J. CHAPMAN

The most widely known member of the order Corrodentia is the minute, apterous indoor species known as the "book louse," *Liposcelis divinatorius* Müll. It appears strange that this and related forms should be considered more or less typical of the order, since an overwhelming majority of the known species are much larger, are fully winged, and are denizens of the outdoors. No generally accepted common name has grown up with the Corrodentia as in the other orders. Some of those suggested include "book-lice," "bark-lice," "wood-lice," and "psocids." The writer considers "psocids" the best name: it is short; it is already in rather common use for at least a portion of the order; its derivation from *Psocus* links it with the primary generic name-stem of the order (a precedent in point is that of the common name thrips for members of the order Thysanoptera); the terms "book-lice," etc., are misleading because none of them are descriptive of the order as a whole and furthermore the word lice in common names of insects is already overworked.

Burmeister's ordinal name of Corrodentia is used here, following Comstock¹ and others. Copeognatha² is used by Dr.

¹ Comstock, J. H. An Introduction to Entomology, 1925.

² Enderlein, G. Über die Morphologie, Gruppierung und Systematische Stellung der Corrodentien. Zool. Anzeiger 26: 423. 1903.

Gunther Enderlein, world authority on the order, while some prefer Psocoptera.

In this paper a study is presented of the American members of suborder Isotecnomera of Enderlein—those psocids possessing two-jointed tarsi in the adult stage. Every species of this suborder in America lives outdoors although at least two thrive indoors. Psocids have apparently made little appeal to collectors and students in the past if one may judge from the scanty collections in our museums and utter absence of a single comprehensive paper on the American fauna. These insects are small, soft bodied, and are both unattractive and difficult to study when pinned. Since psocids have been almost invariably pinned, in the past, this may explain in part the seeming lack of interest in the order. Psocids should be preserved in alcohol.

ACKNOWLEDGEMENT

The present paper is the product of work started in 1924 at Cornell University under the guidance of Dr. J. G. Needham and Dr. O. A. Johannsen. In addition to these men I am especially indebted to Prof. C. R. Crosby. His collections and those in which he was assisted by Dr. S. C. Bishop, almost equal the large amount of material taken by the author. And, what is more important, he collected extensively in parts of the United States where it was impossible for the writer to visit, making this paper more national in scope than would otherwise have been possible.

Six weeks were spent at the Museum of Comparative Zoology at Harvard University in 1926 studying its valuable type collection. For the gift of types and other specimens, and the special privileges afforded, I am indebted to Nathan Banks and Samuel Henshaw of this institution. For similar reasons I wish to thank E. T. Cresson, Jr., of the Philadelphia Academy of Natural Sciences, T. H. Frison of the Illinois Natural History Survey, C. W. Johnson of the Boston Society of Natural History, and E. P. Felt formerly of the New York State Museum.

M. D. Leonard, J. Douglas Hood, T. H. Hubbell and O. C. McBride have been especially active psocid collectors. Others who have taken specimens are: C. P. Alexander, P. P. Babi,

T. C. Barnes, S. W. Chapman, E. N. Cory, R. A. Cooley, Eugene Crosby, E. O. Essig, F. C. Fletcher, C. W. Johnson, P. R. Needham, Chester Rea, O. W. Rosewall, R. M. Seeley, Esther Taub, L. H. Weld and Augusta Wolf.

GENITALIA AND TERMINAL ABDOMINAL SEGMENTS

Excellent taxonomic characters have been found in the genitalia and associated structures of most Corrodentia genera. So little consideration has been given to the homologies and appearances of these pieces by other workers that it is necessary to name and locate the several elements. The generalizations which follow will undoubtedly need revision as these studies proceed and especially when studies are made from a more strictly morphological viewpoint. For this reason the writer has avoided the use of special names for those structures which now appear to be of a secondary nature. The terminology used is principally from Comstock,¹ Crampton,³ Walker^{4, 5} and Chopard.⁶ I have also adopted some suggestions which were kindly made by Mr. R. E. Snodgrass.

FEMALE: In *Psocus*, *Peripsocus*, and certain other genera, a distinct if not long and strongly chitinated ovipositor is present. It is composed of three pairs of gonapophyses, one pair arising from the eighth segment and two pairs from the ninth. In *Cæcilius* and others of its type these pieces are absent, reduced to one or two pairs of insignificant blades or otherwise modified from the hypothetical. The males show a greater variety of genitalic detail than do the females. In *Psocus*, *Lachesilla* and other genera, however, the structures in the females are usually clearly distinctive of the species.

³ Crampton, G. C. A phylogenetic study of the terminal abdominal structures and genitalia of male Apterygota, Ephimerida, Odonata, Plecoptera, Neuroptera, Orthoptera and their allies. Brooklyn Ent. Soc. Bul. 13: 49. 1918.

⁴ Walker, E. M. The terminal abdominal structures of orthopteroid insects: a phylogenetic study. Ent. Soc. Am. Ann. 12: 267. 1919.

⁵ Idem. Ent. Soc. Am. Ann. 15: 1. 1922.

⁶ Chopard, L. Recherches sur la conformation et la developpement des dernier segments abdominaux chez les Orthopteres. Rennes-Imprimerie Oberthur (Insecta) 1920.

The terminal ventral plate (usually the 7th sternite) is called the *subgenital plate*. It frequently has a chitinous or pubescent pattern distinctive of the species. When a definite distal process occurs on the subgenital plate it is called the *egg-guide*. This piece cooperates with the inner gonapophyses in roofing over the passageway of the eggs. The *ventral gonapophyses* are borne on 8th segment, and are almost invariably long, slender and sharp-pointed blades which extend below the egg-guide and project tongue-like from the egg passage. Two pairs of gonapophyses arise from the ninth segment. The *lateral gonapophyses* are small lobe-like or cup-shaped pieces; in *Psocus* they support the dorsal gonapophyses at their base. The *dorsal gonapophyses* are large and trough-shaped—often fleshy—and supported by definite rami. For the sake of convenience, the plates, of various origins, which lie below the subgenital plate are called *interior genital plates*. Three lobe-like pieces guard the anal opening. All three are more or less triangular with the outer surface chitinized and with a group of setæ distally. The median or dorsal lobe is termed the *suranal plate* and the lateral pair are the *paraprocts*. Proximally on the paraprocts occurs a curious tubercle covered with hairs; this is called the *sense tubercle of paraprocts*.

MALE: The male genitalia are both symmetrical and asymmetrical. Considerable difficulty has been experienced in homologizing all of the structures in the suborder. Typically a large plate, similar to, but not homologous with, the subgenital plate of the female occurs in the male; the writer has adopted Crampton's name *hypandrium* for this piece. The *basal sclerite* is the term applied to the proximal division of the hypandrium in such forms as *Psocus confraternus*. In *Psocus* a true penis has not been found, the genital opening lying between a pair of *parameres*. These parameres are usually strongly chitinous and may consist of a pair of hooks (*P. confraternus*) or may be united, and present various specializations. According to Chopard⁶ there are typically two pairs of parameres. This condition apparently obtains in *Cacilius* and related genera.

The paraprocts and suranal plate are similar to those in the female. In *Psocus* however the paraprocts appear to have a

clasping function and the suranal plate in *Lachesilla*, *Ectopsocus*, and others may bear some specialization. Certain pieces with a clasping or other function arise from the primary structures discussed: special names for these have been avoided.

CLASSIFICATION

Enderlein⁷ has divided the Corrodentia into two suborders based principally on the number of tarsal and antennal segments. Psocids with two-jointed tarsi, in both the nymphal and adult stages, and with 13-jointed antennæ are included in the suborder Isotecnomera. It is with these that this paper treats. The members of the other suborder, Heterotecnomera, are characterized by having two-jointed tarsi in the nymphal stages and three-jointed in the adult stage; antennæ are 13 or more jointed.

Families of Isotecnomera may be separated as follows:

- Cu₁ fused to M for a variable distance; wings almost always well developed Psocidæ
- Cu unbranched, or Cu₁ not joined to M or if so by m-cu cross-vein; wings usually well developed but not always Cæciliidæ

The family Psocidæ, in America, is divided into two subfamilies, each represented by a single genus:

- Hairs on veins in basal third of wings; subcostal vein absent. No row of ctenidia on inner surface of metathoracic tibiæ. A single pair of short gonapophyses present in ♀; paraprocts in ♂ without distal claw *Pseudopsocus* n. gen. Pseudopsocinæ
- No hairs on wing veins, base of subcosta distinct; ctenidia present on metathoracic tibiæ. Three pairs of gonapophyses in ♀; a stout prong distally on paraproct of ♂ *Psocus* Psocidæ

The family Cæciliidæ, in America, may be divided into three subfamilies:

- 1—♀ *apterous* (♂ of American forms not known); segments of thorax of about equal size; head elongate, relatively narrow between eyes, clypeus flattened; buccal rods stout, bearing about 8 teeth.
..... *Bertkauia* Bertkauiinæ
- ♀ *subapterous* or *brachypterous*, but usually *macropterous*; prothorax greatly reduced; head broad, clypeus bulging; buccal rods slender, forked 2

⁷ Enderlein, G. Zool. Anz. 35: 172. 1909.

Family PsocIDÆ

Both sexes of a number of American species are not known, and this, for one reason, makes it appear unwise at this time, to erect new genera for the inclusion of species with a *Psocus*-like wing venation based on the genitalia. The writer is forced therefore to consider the following tentatively as synonyms: *Cerastipsocus* Kolbe 1885, *Amphigerontia* Kolbe 1880, *Trichadenotecnum* Enderlein 1909, and *Loensia* Enderlein 1924.

KEY TO PSOCUS

- 1—Markings present or not on fore-wings, if present confined to proximal three-fifths (proximal to a line drawn from distal end of pterostigma to Cu_2) excepting small spots at end of veins and obscure clouding. Wings ranging from hyaline to deep fumose.....15
 - Definite spots or bands in distal two-fifths as well as in proximal portion of wings..... 2
- 2—Head narrow, vertex depressed and produced laterally into pedestals for reception of eyes 3
 - Interval between eyes nearly straight or convex, eyes not prominently elevated 4
- 3—A rather narrow band in proximal three-fifths of wing *elegans*
 - Markings covering most of proximal portion of wings *lichenatus*
- 4—Series of six small dark brown spots in cells R_1 to M_3 inclusive and proximal to a band at wing margin 5
 - No such series of spots..... 6
- 5—Lateral plates of subgenital plate equilateral triangular; distal prongs on hypandrium asymmetrical..... *quasitus* n. sp.
 - Subgenital plate rectangular; hypandrial prongs symmetrical. *slossonae*
- 6—Wing markings consisting of numerous small spots, no distinct bands or large spots 7
 - Marked with bands or large spots.....10
- 7—Spots small, rarely coalescing and not attaining wing margin in distal half *conspersus*
 - Spots profuse, coalescing in certain areas and more or less covering entire wing 8
- 8—Three triangular spots anteriorly on clypeus; a large symmetrical notched prong on hypandrium..... *desolatus* n. sp.
 - Clypeus with usual lines, pale posteriorly. Hypandrium with asymmetrical median ridge and arising to its left a secondary prong 9
- 9—Hypandrial prong two-thirds as long as ridge *moestus*
 - Prong very short, appearing merely as a notch at base of ridge. *maculosus*
- 10—Marking in distal two-fifths of wing a spot the size of cell M_3 and either confined there or extending into cell Cu_1 *oppositus*
 - Not so marked11

- 11—A distinct cross on clypeus; wings 3.7 to 4.0 mm. long with a band along outer margin.....*pollitatus* 12
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 —Wings about 3 mm. or shorter..... 14
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trifasciatus
 —Head markings faded, three pairs of dark spots: on vertex, at ocelli and laterally on front.....*novaescotiae* in part
 —Usual pigmented areas on vertex tan mottled with fine reddish lines; clypeal lineation distinct, at least posteriorly.....*hoodi* n. sp.
 14—Wings about 2.4 mm., mostly deep fumose with a transverse hyaline band midway.....*atratus*
 —Wing marked with a band along outer margin and one from base of pterostigma to anal veins.....*submarginatus*
 —Wing markings bordering veins in distal half, no distinct bands.
coquilletti
 15—Head dull orange throughout, no distinct spots or lineation. Wings deep fumose, those of ♀ 6.4 mm. long, ♂ 4.7 mm.*venosus*
 —Wings if fumose not strongly so. Spots and lineation usually distinct on vertex and clypeus, respectively..... 16
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subapterous n. sp.
 —Wings of ♀ hyaline about 3 mm. long.....*cockerelli*
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 —Wings about 4.5 mm. or shorter..... 23
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 —Wings unmarked. R₁ conspicuously white in proximal half and black or brown in distal half.....*purus*
 21—On head, pairs of spots: on vertex, at ocelli and on front.
 —Usual lineation on clypeus and dots on vertex indistinct.
novaescotiae in part
 —Dotted areas on vertex and lineation on clypeus distinct..... 22
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 —Pterostigma long and shallow, r-m present or not. Median prong on hypandrium unforked.....*longipennis* ♂
 —Pterostigma sub-angulate; a broad band in proximal half of wing.
crosbyi n. sp.

- 37—Marking in proximal half of wing triangular.....38
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 —No spots at end of veins, wing length about 4.3 mm. *striatus*
 39—Egg-guide with lobes at base; a ridge on hypandrium gradually narrows and twists to left..... *bisignatus*
 —Egg-guide narrow at base; hypandrial structure large, complex—not a simple ridge *texanus*

***Psocus atratus* Aaron**

Psocus atratus Aaron. Am. Ent. Soc. Trans. **11**: 39. Pl. 9, Fig. 6. 1883.

Female:

Length of body 2.4 mm.

Length of fore-wings 2.4 mm.

Head and thorax above, uniformly shining deep brown gradually paling on the sides and below; abdomen paler, greyish brown, paling below. Maxillary palpus dark brown. Antenna slender, sparsely clothed with very long fuscous hairs. Eyes dull, purplish black.

Thorax: Legs dark brown. Wings (Pl. XX, Fig. 17) brown with a few paler or hyaline areas. Pterostigma very deep, R_1 bent abruptly to wing margin but the cell non-angulate. An incomplete hyaline band from basal third of pterostigma to wing margin at cell Cu_1 ; cells R_3 and R_5 , distal half of cell R_1 fumose while cells formed by media margined with fumose. A hyaline spot at wing margin in cells M_3 , Cu_1 and the distal part of cell 1A. Veins conspicuous, brown. Hind wing faintly fumose, darker along costal margin and in anal cell.

Abdomen: Terminal segments and genitalia (Pl. XIII, Fig. 5). Sub-genital plate and egg-guide form a very much thickened inverted letter "Y." A highly chitinized strip marks off the base of the egg-guide which is otherwise contiguous. Egg-guide blunt-pointed, apex pilose. Ventral gonapophyses short, just attaining end of egg-guide. Lateral gonapophyses large, elongate, cup-like, uniformly chitinized and with a row of hairs along distal margin. Dorsal gonapophyses with rather narrow rami, apex pointed; a large brown area bordering mesal margin and involving the apex. Paraprocts stout, the row of hairs

along latero-ventral margin long, closely set; sense tubercles brown. Suranal plate triangular, rather long and narrow; a triangular non-chitinized area proximally.

New York: Painted Post, Sept. 15, 1925, 1 ♀ on trunk of elm.

Pennsylvania: Near Philadelphia, 2 specimens (S. F. Aaron) P. A. N. S. In crevices of the bark of a black oak in woods. Holotype and Paratype.

Virginia: Falls Church July 14 to Sept. 29 a total of 12 specimens (Banks) M. C. Z.

***Psocus bisignatus* Banks**

Psocus bisignatus Banks. Ent. Soc. Wash. Proc. 6: 203, Pl. 2, Fig. 10. 1904.

Female:

Length of body 3.0 mm. ave. of 8 individuals.

Length of fore wings 3.5 mm. ave. of 8 individuals.

Length of antennæ 2.8 mm. ave. of 8 individuals.

Head and thorax marked with deep golden brown, abdomen whitish striped with grey.

Head: Dotted areas on vertex distinct, brown; front margined with brown posteriorly and with a V-shaped mark medianly; clypeus lineated with rather broad parallel lines; posterior third of clypeolus and two-thirds of labrum brown; genæ touched with brown, no distinct spots. Eyes black, large. Antennæ and maxillary palpus brown.

Thorax: Rather completely marked with brown; tergal lobes shining rich brown. Legs beyond coxæ pale brown, tarsi darker. Wings (Pl. XX, Fig. 24) hyaline marked with rich brown. The pterostigma opaque, deep; R_1 subangulate; the distal two-thirds of cell brown. Just below inner angle of pterostigma a spot; a broad irregular band from base of pterostigma to end of cell 1A; most of cell 1A brown. Veins brown and in some individuals the veins in proximal three-fifths of wing margined with brown. Hind wing hyaline.

Abdomen: Terminal segments and genitalia brown. (Pl. XII, Fig. 15.) Proximally the subgenital plate consists of a pair of lateral somewhat triangular plates. At base of egg-guide a pair of small lateral lobe-like plates; the distal two-thirds rec-

tangular becoming slightly wider distally; apex truncate, non-chitinized, pilose; median part of egg-guide weakly chitinized. Ventral gonapophyses short, of usual shape. Lateral gonapophyses cup-like with a strongly chitinized pilose basal portion. Dorsal gonapophyses with sharp-pointed apex; mesally a small infuscated area. Paraprocts narrow, sense tubercles brown. Suranal plate roughly trapezoidal above, supported laterally by chitinized strips and at the distal three-fifths by a transverse bar.

Male:

Length of body 2.8. mm. ave. of 7 individuals.

Length of fore wings 3.3 mm. ave. of 7 individuals.

Length of antennæ 3.0 mm. ave. of 7 individuals.

Marked as female. Eyes phosphorescent, bluish green, very large. On abdomen below and almost touching genital processes a pair of brown spots.

Terminal segments and genitalia occupying a little more of abdomen than those of female, dark brown, asymmetrical. Hypandrium (Pl. XV, Fig. 6) jaw-like, giving rise medianly to a relatively broad, highly chitinized ridge which arches and narrows distally, and curves to the left, finally bending abruptly cephalad. Parameres (Pl. XV, Fig. 19) fused to form a triangle, apex truncate, bearing medianly inside a short prong which does not project beyond the apex. Paraprocts bear distally an upward pointing prong and near apex, a slight elevation bears a pair of stout spines. Suranal plate semicircular, with a conspicuous chitinized margin.

New York: Ithaca, Aug. 22, 1926, 8 ♀ 2 ♂ on dead hemlock and pine limbs, 1 ♀ 7 ♂ 6 nymphs 1925. Reared indoors by P. P. Babiý from limbs of deciduous trees, Aug. 6, 2 ♀ 1 ♂, Sept. 26, 1926, 1 ♀, Aug. 15, 1926, 2 ♂, July 11, 1926, 6 ♀ 1 ♂, Sept. 6, 1926, 1 ♀; Baiting Hollow, Suffolk Co., Sept. 19, 1926, 2 ♀; Sea Cliff, Sept. 5, 1925, 1 ♀ 6 ♂.

New Jersey: Englewood Cliff, Sept. 6, 1925, 2 ♀.

Tennessee: Mill Creek below falls on Mt. Leconte, Oct. 10, 1926, 1 ♀ (C. & B.).

Virginia: London Bridge, Aug. 25, 1929, 1 ♀. Falls Church, 25 June, 1 ♀ (Banks). Holotype. M. C. Z.

Psocus campestris Aaron

Psocus campestris Aaron. Acad. Nat. Sci. Phila. Proc. **38**: 14. 1886.

Known only from holotype, a male, in the Philadelphia Academy of Natural Sciences. It was collected by Aaron in "Southern Texas—from the live oak trees that compose the small groves (motts) on the prairies." The wings are about 2.5 mm. long and the pterostigma is of moderate depth, subangulate, and with a dark spot at the inner angle; R_1 is black before the angle and whitish beyond. While it was not possible to examine the terminal abdominal segments and genitalia critically they are not of the type represented by *confraternus* but more like *moestus*. The head markings are not unusual.

Psocus confraternus Banks

Psocus semistriatus Walsh. Acad. Nat. Sci. Phila. Proc. **14**: 361. 1862. *Partim* (1 ♂ of Paratypes).

Psocus confraternus Banks. Am. Ent. Soc. Trans. **32**: 2. 1905.

Psocus moderatus Banks. N. Y. Ent. Soc. Jour. **15**: 165. 1907.

Psocus additus Banks. Mus. Comp. Zool. Bul. **62**: 3. 1918 (♂).

Amphigerontia confraterna Enderlein in Dampf Sitz. Natur.-Gesell. Univ. Dorpat **31**: 35. 1924.

Female:

Length of body 4.0 mm. ave. of 11 individuals.

Length of fore wings 4.6 mm. ave. of 11 individuals.

Length of antennæ about 4 mm.

Profusely marked with dark brown, the abdomen grey suffused with purple.

Head: The dotted area on vertex distinct; a V-shaped mark midway on front; clypeus lineated with distinct nearly parallel lines fading out near the anterior margin; genæ unmarked except at margins; clypeolus and labrum brownish. Maxillary palpus fuscous, apical segment darkest, 3rd segment palest. Eyes phosphorescent, bluish-green.

Thorax: Rather completely marked with brown, margins of tergal lobes and sutures on sides whitish. Coxæ brown; femora, above, brownish; tarsi dark. Wings (Pl. XX, Fig. 10) pale

fumose, in some individuals nearly hyaline, marked with brown; pterostigmal area whitish, opaque. Pterostigma moderately deep, R_1 subangulate (slightly concave before inner angle beyond which it becomes slightly convex); a brownish area involves the distal half of the cell, extending below R_1 . An irregular brownish band from base of pterostigma to end of anal veins; towards base of wing, a series of three spots suggesting a band; an indistinct spot in cell R_5 behind R_s furcation. Veins brown paling basally; R_1 pale. *Cross vein r-m long, always present.* Hind wing unmarked; in some individuals r-m present but usually very short or absent.

Abdomen greyish, suffused with purple, light at the sutures and pale below. Terminal abdominal segments and genitalia (Pl. XII, Fig. 9). Base of subgenital plate composed of a pair of broad, lateral plates, joined caudally by a transverse nearly straight slender strip from which arises medianly the elongate egg-guide. The strips and egg-guide form an inverted "T." Medianly on the strips a pair of short narrow "roots" proceed cephalo-laterad, in some individuals touching the lateral plates. Egg-guide made up of three chitinized areas: the proximal part swollen medianly and highly chitinized—a continuation of the transverse strips on the basal portion of subgenital plate; the distal portion evenly rounded, white; the intermediate section lightly chitinized, widest distally. Ventral gonapophyses relatively strong but of usual shape drawn out to a point apically. Lateral gonapophyses broad, strongly chitinized, consisting of two parts: a strong pilose basal portion and a non-pilose piece which fits sleeve-like around the base of the dorsal gonapophyses. The dorsal gonapophyses narrowing distally, giving rise to a sharp, drawn-out apex. Sense tubercles on paraprocts large, brown, set in a concolorous field. Proximal two-thirds of suranal plate chitinized, distal third evenly rounded, white.

Male:

Length of body 3.4 mm. ave. of 9 individuals.

Length of fore wings 4.4 mm. ave. of 9 individuals.

Length of antennæ about 4.0 mm.

Marked as in female. Wings inclined to be uniformly fumose, the markings indistinct. Eyes very large, slightly ovate, nearly twice as large as female.

The distal two-fifths or more of the abdomen capped by the highly chitinized terminal segments and genitalia: structure symmetrical (Pl. XIV, Fig. 6). Hypandrium proper triangular (viewed from below) bearing distally a characteristic group of three strongly bent hooks. Basal sclerite of hypandrium broad and relatively long. The median hook (Pl. XIV, Fig. 12) distally on hypandrium curves strongly cephalically, ending in a relatively much drawn out sharp point. It is constricted basally and is supported by slender chitinized strips which, from their lateral spread and abrupt ending, form a triangle with the vertex at base of the hook. On each side of this median hook arises a blunt hook which curves mesally and gradually dorsally. The three pieces, viewed from below, appear to be of equal size and shape. These lateral lobes are blunt-pointed and consist of two parts; the overlapping basal portion ends midway, but from below this condition is usually not visible. The parameres (Pl. XIV, Fig. 8) lying below the hypandrium are independent, caudo-laterally curved pieces. The slender proximal portion of the paraprocts widen to bear the brown sense tubercle; the apical portion is twisted bearing distally a blunt triangular hook. Suranal plate with a late arising perpendicularly which in profile bears lateral lobes.

New York: Whetstone Gulf, Lewis Co., Sept. 2, 1926, 1 ♂; Nigger Pond, Oswego Co., Sept. 3, 1926, 6 ♀ 7 ♂; Saratoga Springs, July 15, 1926, 13 ♀ 2 ♂ on dead pine and oak limbs; Ithaca, July 5, 1926, 2 ♀, July 11, 1926, 8 ♀ 2 ♂ on dead limbs, Aug. 22, 1926, 2 ♀ 3 ♂ on dead pine and hemlock limbs, Aug. 28, 1925, 1 ♂ (T. C. Barnes) on upper shoot of *Pinus strobus*, Sept. 26, 1926, 1 ♀; McLean Reservation, July 31, 1926, 7 ♀ on dead hemlock limbs; Hudson, July 15, 1926, 1 ♀; Ballston Lake, July 14, 1926, 9 ♀ on dead oak and pine limbs; West Barre, Sept. 19, 1925, 2 ♀ 1 ♂; Ceres, Sept. 16, 1925, 11 ♀ 1 ♂ beating dead limbs; Wellsville, Sept. 15, 1925, 14 ♀ 3 ♂ 4 nymphs, on dry roots of hemlock which had blown down; Rock City, Sept. 16, 1925, 35 ♀ 5 ♂ on dead limbs; Painted Post, Sept. 15, 1925, 1 ♀; Stow, Sept. 17, 1925, 5 ♀ on dead limbs; Little Valley, Sept. 17, 1925, 5 ♀ 1 ♂; Richburg, Sept. 16, 1925, 9 ♀ 2 ♂ on dead limbs; Penn Yan, Aug. 29, 1926, 1 ♀ 2 ♂; Sacandaga R., Fulton Co., June 27, 1910 1 ♀ Holotype of *P. additus* Banks, M. C. Z.

New Hampshire: Mt. Washington, 1 ♀ (Mrs. Slosson) Holotype M. C. Z.

Massachusetts: Worcester, Sept. 11, 1926, 1 ♀ (W. T. M. Forbes).

Maine: Mt. Katahdin, 1 ♂ Holotype *P. moderatus* Banks, M. C. Z.

Tennessee: Bristol, Oct. 5, 1926, 1 ♀ 2 ♂ taken at light of Coca-cola stand (C. & B.).

North Carolina: Base of Mt. Pisgah, Buncombe Co., Oct. 13, 1926, 1 ♂ (C. & B.).

Georgia: Tallulah Falls, Oct. 18, 1926, 1 ♀ (C. & B.).

California: Oakland, Apr. 17, 1915, 1 ♂ (E. P. VanDuzee) supplied by E. O. Essig; Berkeley, Sept., 1914, 1 ♀ supplied by N. Banks.

***Psocus cockerelli* Banks**

Psocus cockerelli Banks. Am. Ent. Soc. Trans. **30**: 100. 1904.

This species is represented by the holotype, a female, in the Museum of Comparative Zoology. It was collected by Prof. Cockerell Oct. 6, "on aster, at Whitewater by White Sand, New Mexico." The wings are hyaline and unmarked (outside of pterostigma); this cell is of moderate depth and rounded, a dark spot occurs at the inner "angle" resembling the condition in *quietus*. Wing length about 3.4 mm. Four spots occur on the clypeus, and the front is small and elliptical, since the arms of the epicranial suture are broadly joined to the clypeus.

It appears to be closely related to *P. subapterous* n. sp. and probably belongs to the "*quietus* group."

***Psocus conspersus* Banks**

Psocus conspersus Banks. Ent. Soc. Wash. Proc. **5**: 237. Pl. 4, Fig. 1. 1903.

This spotted winged species is rather distinct from others with similarly marked wings (*moestus*, *maculosus* and *desolatus* n. sp.) in that the spots are small and rarely coalesce. In the apical half of the wing small points are found at the end of the veins but the spots in the cells do not attain the edge of the wing. Banks gives the length for the species as 3 mm. I am not sure

but what some of the paratypes accompanying the holotype in the National Museum, Washington, D. C., represent another species; no specimens were available for a critical study of the genitalia. The specimens are recorded from Williams and Tucson, Arizona. A drawing of the fore-wing of the species accompanies the original description: R is indicated as joined to M at a point; the pterostigma is of moderate depth and rounded.

***Psocus coquilletti* Banks**

Psocus coquilletti Banks. Mus. Comp. Zool. Bul. **64**: 305. Pl. 1, Fig. 7. 1920.

This small species ("Length 3 mm.") is represented by the holotype, a female, taken in Los Angeles, California, by Coquillett in 1889. The markings on the wings appear distinctive and are figured by Banks as indicated in the citation.

Holotype in Museum of Comparative Zoology.

***Psocus crosbyi* new species**

Female:

Length of body 4.0 mm.

Length of fore wings 5.3 mm.

The dotted areas on vertex distinct; a V on the front. Clypeus with lineation more distinct medianly. Clypeolus and labrum brown, and on genæ a brown spot. Apical segment of maxillary palpus brown. Antennæ brown, segments 2 and 3 pale. Eyes dull bluish black.

Tergal lobes rich brown. Pleuræ and coxæ mostly brown, tarsi brown. Wings hyaline or subhyaline (Pl. XX, Fig. 19). An incomplete brown band with distal border running from base of pterostigma to end of anal veins. Pterostigma deep, with R_1 subangulate; distal two-thirds brown, the pigmentation extending below the cell; a pale fumose spot in cell R_5 with faint touches along outer margin of wing. Veins distinct.

Abdomen dirty white coarsely and incompletely banded with grayish-brown. Terminal segments and genitalia (Pl. 12, Fig. 1). The proximal portion of subgenital plate narrow, widening laterally. The egg-guide broadly attached, blunt-pointed, chitinization forming an inverted "Y." Ventral gonapophyses of usual shape, sharp-pointed. Lateral gonapophyses cup-like, white, with some brown proximally, pilose; distal margin wide and pilose. Dorsal gonapophyses very large and fleshy although the piece is abruptly produced into a point distally. The dorso-mesal surface infuscated and likewise the mesal portion of the ventral surface of the paraprocts. Paraprocts of usual shape with sense tubercles brown, large. Suranal plate white above, gently rounded distally.

Washington: Longmire 22 Aug., 1927, 2 ♀ (Coll. Prof. C. R. Crosby). Holotype and Paratype.

***Psocus desolatus* new species**

Male:

Length of body 2.8 mm.

Length of fore wings 4.3 mm.

Similar to *moestus* in wing markings and general appearance but genitalia show relationship with *slossonæ* and *quaesitus* n. sp.

Head sulphur yellow above, indistinctly marked with pale brown dots; ocelli placed in a small black spot; genæ brown with a median whitish area. Covering the anterior three-fifths of the clypeus a conspicuous mark formed by the fusion medianly of the vertices of three brownish, roughly triangular areas; remainder of clypeus whitish except for the coarse lineation on the posterior two-fifths which does not, however, continue to the margin. Clypeolus and labrum light brown, maxillary palpus brown, except third segment pale. Eyes dull bluish black.

Thorax: Dull yellowish and pale brown above; sides brownish; legs pale, a brownish spot or two on outer surface of femora, tibiae with brownish ring distally. Wings hyaline marked in a manner similar to *moestus* with numerous brownish spots. Veins pale brown, darker apically. M joined with Rs a short distance.

Abdomen: Sternites brownish gray; tergites pale yellowish, coarsely marked with brown at the sutures. Hypandrium (Pl. XV, Fig. 2) roughly diamond-shaped, symmetrical except for the pair of prongs on the distal margin. The left prong is nearly twice as long as the right one. An elongate median piece is attached a short distance above the ventral margin of hypandrium and extends to the dorsal margin; it is highly chitinized and distinctly notched apically; lateral margins of distal two-thirds parallel, basal portion swollen; apical half unattached, jutting out at a considerable angle from hypandrium; a pair of elliptical holes through hypandrium at the base of this piece. Arising from the lateral margin of hypandrium a pair of slenderly attached pieces which terminate in strongly chitinized mesally facing hollow claws. Parameres fused, consisting of slender arms forming an elongate heart-shaped structure; attachment proximally, below hypandrium at base of the median structure. Sense tubercles on paraprocts large, much elevated; the sharp claw which arises below and near the apex is bent dorsally past the termination of the piece. Paraproct broad, only strongly chitinized at sense areas and apex. Suranal plate with a curious triangular-shaped part arising perpendicularly as in *slossonæ* and *ornatus*.

Colorado: Pingree Park, Aug. 20, 1924, 1 ♂ Coll. Prof. C. R. Crosby. Holotype.

***Psocus elegans* Banks**

Psocus elegans Banks. Ent. Soc. Wash. Proc. 5: 203. 1904.

Female:

Length of body 3.0 mm.

Length of fore wings 3.0 mm.

Length of antennæ 2.8 mm.

Pale orange marked with several shades of brown. The shape of the head similar to *lichenatus*; the two species distinctly different from other American forms in this and other particulars. The head narrow except between the eyes where it is also strongly concave; laterally the vertex is drawn out forming pedestals for the reception of the eyes. Markings on head dull orange or sulphur above, a pair of dark brown bands above antennæ fused with markings on the clypeus which are dark brown laterally and anteriorly (a triangular posterior portion light brown); labrum dark brown; genæ unmarked except for a few dots just below the eyes. Antennæ pale, sparsely clothed with long hairs. Maxillary palpus pale. Eyes globular dull black.

Thorax: Tergal lobes brown, sides scantilly marked with brown. Legs pale, brown spot or band proximally on tibia; tarsi brown. Wings hyaline marked with two shades of brown spots. Pterostigma opaque with a definite dark brown spot covering distal one-third of the cell and also extending slightly below R_1 ; cell deep, R_1 rounded. Three large dark brown spots arranged to form an incomplete band, one at origin of Rs, the second at fork of vein RM and the third in distal three-fifths of cell 1A. An irregular dark brown spot covers about half of cells Cu_1 and M_3 . Cells M_1 and M_2 each have a small dark brown spot. A small light brown spot at end of veins R_{2+3} to Cu_2 inclusive. Veins pale. M fused with Rs a short distance. Hind wings unmarked.

Abdomen pale, coarsely marked with brown. Terminal segments and genitalia (Pl. XIII, Fig. 1). Subgenital plate triangular with strongly chitinized side pieces which are broad basally and drawn out to a point distally; apex truncate bearing a row of 5 or 6 hairs; what is probably the 7th sternite extends forward between the highly chitinized side pieces to a point almost half the length of the structure. Ventral gonapophyses

very long and slender. Lateral gonapophyses large, weakly chitinized, convex, oblong, bearing a row of hairs along the distal margin. Dorsal gonapophyses rather weakly chitinized, sharp-pointed apically. Paraprocts long and slender. Suranal plate triangular.

Virginia: Falls Church, Aug. 5, ♀ Holotype; July 12, 1 ♀ and July 17, 1 ♀, Paratypes; Aug. 8-10, 2 ♀ on bark of white-wood, chestnut and oak (all Banks) M. C. Z. Great Falls, 1 ♀ (Banks) M. C. Z.

New York: Ithaca, Aug. 22, 1926, 1 ♀ on cliff wall.

Psocus floridanus Banks

Psocus floridanus Banks. Am. Ent. Soc. Trans. **32**: 2. 1905.

Female:

Length of body 3.0 mm. ave. of 6 individuals.

Length of fore wings 3.5 mm. ave. of 6 individuals.

Length of antennæ 3.1 mm. measurement of 1 specimen.

This species is closely related to *straitus* from which it may be distinguished by the smaller size and presence of spots at end of veins in fore wings. The basal three-fifths of wing as in *striatus*: in intensely colored specimens, the distal two-fifths of the wing fumose, the pigment attaining the margin at the end of veins (Pl. XX, Fig. 26). In most specimens all that is readily seen is a brown spot at the end of veins Cu_1 to R_{2+3} inclusive.

The subgenital plate (Pl. XII, Fig. 3) and basal portion of egg-guide nearly uniformly chitinized throughout; a distinct deep notch medianly on subgenital plate dividing the piece. Other structures similar to *striatus* except that the suranal plate bears a non-chitinized crescent proximally.

Male:

Length of body 3.2 mm.

Length of fore wings 3.9 mm.

Genitalia differing only slightly from *striatus*, as follows: the medium part of hypandrium (Pl. XV, Fig. 3) very slender and slightly grooved distally; the lateral plate on the left side not as broad basally; the strongly chitinized apical portion of the fused parameres occupies the distal half, and the plate at the base is inclined to be hexagonal; viewing the parameres (Pl. XV,

Fig. 22) from the rear, structure *in situ*, the right projection is stouter, with a slight depression on the inner surface and the left projection is twisted, flattened and fairly wide.

New York: Geneseo, Sept. 20, 1925, 1 ♀ on dead oak limb; Michigan Mills, Sept. 14, 1926, 1 ♂; Clarksburg, Sept. 18, 1925, 2 ♀ on tree trunks; Wellsville, Sept. 15, 1925, 2 ♀ on dead limbs.

Virginia: Caret, Oct. 28, 1926, 1 ♀ (C. & B.)

Florida: Biscayne Bay, 1 ♀ M. C. Z. Holotype.

***Psocus hoodi* new species**

Female:

Length of body 6 to 6.5 mm.

Length of fore wings 5 to 6 mm.

Length of antennæ about 10 mm.

Closely related to *Psocus novaescotiæ* Walker.

Head: On vertex an inverted U of white while an area above eyes and one involving the epicranial suture tan, and curiously mottled with a few thin reddish-brown lines. These margin the U-shaped white area and occur irregularly through the tan areas. Front with a triangular spot medianly and a pair of broad lines laterally from ocelli; other lines occur at clypeal margin, leaving a pair of conspicuous unmarked crescents on the front. Clypeus lined with relatively narrow brown parallel lines which fade in anterior third. Labrum touched with brown. Genæ infuscated, no distinct spot. Antennæ very long, slender and dark brown except segment three paler. Eyes dull bluish black.

Thorax: Anterior part of tergal lobes dark brown, posterior portion pale; pleuræ mostly unmarked. Coxæ brown, other leg segments much paler brown, tarsal segments darkest. Wings (Pl. XX, Fig. 15) hyaline, conspicuously marked with brown. Pterostigma milky white, rather deep— R_1 subangulate. A V-shaped brown mark starting at the middle of pterostigma, across to cell Cu_1 and thence along wing margin to vein R_{4+5} . A broad and rather irregular band from base of pterostigma, ending along anterior half of vein 2A. Veins coarse, brown, M reaching R_s at a point. Hind wing unmarked.

Abdomen: Broadly ringed with purplish grey. Terminal segments and genitalia (Pl. XII, Fig. 8). The subgenital plate composed of two parts: the basal portion which bears a chitinized inverted short "Y" (the interval between arms of the Y not acute) and the elongate egg-guide which arises behind the point where subgenital plate is infolded. The egg-guide is supported laterally by rami arising proximally and extending about halfway. The lateral gonapophyses cup-shaped, wide and short; outer surface brown, long hairs scattered over outer surface and at distal margin. Dorsal gonapophyses fleshy, trough-shaped, with an evenly rounded apex; an h-shaped (viewing right one) distal portion to internal rami. Ventral

gonapophyses very long and of usual shape—not visible with structures *in situ*. *Sense tubercle on paraproct white*; latero-ventral margin and dorso-distal portion of paraprocts pilose. Suranal plate triangular, composed of two parts, of which the distal element is triangular and infuscated.

Male:

Length of body 4.5 mm.

Length of fore wings 6.2 mm.

Resembles female closely, less robust; eyes only slightly larger; antennæ stouter, more pilose.

Terminal abdominal segments and genitalia (Pl. XV, Fig. 1) strongly chitinized, asymmetrical, and very similar to *novaescotiae*. The distal process arising from the jaw-like hypandrium consists of two parts separated by a transparent J-shaped portion. The left piece is concave, undulate and smooth-surfaced. A series of teeth appear behind a ridge marking the lateral margin of the left-part proper. The right hypandrial element consists of a median ridge which bears about six teeth and arises *from the extreme right* forming an ear-like lateral surface; the mesal portion concave and surface undulate. The median ridge branches distally and bears about four teeth along left branch. The parameres fused as in *novaescotiae*, notched apically, but slightly enlarged before apex. Paraprocts tipped with a strong dorsally pointed prong. Suranal plate consisting of two pieces; the distal margin truncate; the distal plate with chitinous arms laterally, extending into basal plate.

Arizona: Nogales, Aug. 30, 1927, 2 ♀ 1 ♂ on dead mesquite branches coll. J. D. Hood. Holotype (♂) Allotype, Paratype.

***Psocus infernicolus* new species**

Male:

Length of body 3.0 mm.

Length of fore wings 6.0 mm.

Closely related to *confraternus*, *montivagus* and *petiolatus* (also *P. bifasciatus* Latr. of Europe).

Dotted areas on vertex distinct. Ocellar interval black. A rectangular mark medianly on front; arms of epicranial suture not touching clypeus. Clypeus adorned with distinct brown parallel lines. Labrum brown, genæ unmarked. Eyes large, dull bluish black. (Antennæ missing.)

Thorax: A golden brown throughout, including coxæ—other leg segments a lighter brown. Wings faintly brown, inconspicuously marked with a band running from base of pterostigma to base of anal veins and an indication of another proximally. Pterostigma of moderate depth, rather evenly rounded at inner "angle" and with a brownish spot involving the central two-thirds of cell but not including apex. Veins golden brown throughout. A very long r-m cross-vein present in fore wings (and from its length in the holotype it is expected that this condition is a constant).

Abdomen slender, ringed with greyish brown and capped by the highly chitinized terminal segments. The terminal prongs on hypandrium similar to the *confraternus* group (Pl. XIV, Fig. 4). The median prong is widely forked distally (Pl. XIV, Fig. 14). When viewed from above, it resembles the condition of this piece in *bifasciatus* Latr. (Pl. XIV, Fig. 13); there is not, however, the dilation about midway found in *bifasciatus*. The lateral prongs show some differences as figured. The parameres resemble those figured for *confraternus*. Suranal plates with a weakly chitinized rectangular plate directed cephalad.

Wyoming: West Thumb, Yellowstone National Park. 28 Aug. 1927, 1 ♂, coll. C. R. Crosby. Holotype.

Psocus infumatus Banks

Psocus infumatus Banks. N. Y. Ent. Soc. Jour. 15: 165. 1907. Female:

Length of body 3.3 mm. ave. of 7 individuals.

Length of fore wings 4.0 mm. ave. of 7 individuals.

Length of antennæ 3.9 mm. ave. of 6 individuals.

Related to *striatus* Walker from which it differs as follows: A pair of brown spots on the front and a pair on genæ. The wings (Pl. XX, Fig. 13) are almost entirely fumose; in fully colored specimens, strongly fumose. Hind wings pale fumose. The abdomen ringed with brown paling below.

The subgenital plate (Pl. XIII, Fig. 8) and egg-guide uniformly chitinized. The interval between the lateral plates triangular. Lateral gonopophyses large, the chitinized basal portion larger than in *striatus*. On the inner surface of the dorsal gonopophyses a large dark area. Suranal plate strongly chitinized basally giving rise distally to thin lateral strips.

Male:

Length of body 2.8 mm. ave. of 8 individuals.

Length of fore wings 4.1 mm. ave. of 8 individuals.

Length of antennæ 4.1 mm. ave. of 6 individuals.

Marked as in female. Wings often so strongly fumose that the band from base of pterostigma to end of anal veins is barely visible. A spot on each side of abdomen below, almost touches genitalia. The genitalia asymmetrical differing from *striatus* as follows: the median ridge of hypandrium (Pl. XV, Fig. 4) swollen basally especially on the left side and the piece turns

to the right distally; parameres (Pl. XV, Fig. 7) fused, triangular terminating in a pair of asymmetrical flat lobes from which arises midway a long sharp prong; the paraprocts bear distally a single large upward-pointing prong. Suranal plate large quadrate.

New York: Ithaca, July 11, 1926, 9 ♀ 2 ♂, Aug. 6, 1926, 2 ♀, Sept. 26, 1926, 1 ♀; Saratoga Springs, July 14, 1926, 3 ♀, 1 ♂ on dead limbs; Whetstone Gulf, Lewis Co., Sept. 2, 1926, 1 ♀ 2 ♂, on dead limbs; Painted Post, Sept. 15, 1925, 1 ♀ 1 ♂ on dead pine limbs; Geneseo, Sept. 20, 1925, 1 ♀.

Tennessee: Bristol, Oct. 5, 1926, 1 ♀ 4 ♂ (C. & B.). Taken at light of Coca-cola stand.

Virginia: Falls Church, 1 ♀ (Banks). M. C. Z. Holotype.

Psocus inornatus Aaron

Psocus inornatus Aaron. Am. Ent. Soc. Trans. **11**: 39. 1883.

Female:

Length of body 3.0 mm. ave. of 7 individuals.

Length of fore wings 3.4 mm. ave. of 7 individuals.

Length of antennæ 2.5 mm. ave. of 7 individuals.

Yellowish white marked with brown; the abdomen marked with grey mixed with brown.

Head: The lateral areas on vertex faint; involving the epicranial suture, however, a wide dark brown area proceeds anteriorly to enclose the ocelli and extends to the margin of the clypeus; clypeus lineated with close set golden brown lines; labrum dark brown; genæ unmarked. Eyes small dull bluish black.

Thorax: Tergal lobes shining brownish black. Legs pale, tarsi and distal half of tibiæ brown. Wings (Pl. XX, Fig. 25) faintly fumose throughout. The pterostigma opaque, with the distal half, or more, clouded with brown; R_1 evenly rounded, the cell of moderate depth. Veins brown. M usually joined to Rs at a point.

Abdomen marked with greyish brown, splotted above, arranged in stripes on the sides, pale below. Terminal segments and genitalia (Pl. XIII, Fig. 12). Base of subgenital plate consisting of a pair of nearly square lateral plates which are joined

distally by arms which form an inverted V. The distal portion of egg-guide rounded, distal margin pilose; the proximal portion consists of a highly chitinized central part and a pair of less highly chitinized lateral plates. Ventral gonapophyses of usual size and shape. Lateral gonapophyses large, sleeve-like, strongly chitinized at base and with a row of hairs below and at end of chitinization. Dorsal gonapophyses sharp-pointed, with a pair of small brownish areas, one touching the mesal and the other the lateral margins. Sense tubercles of paraprocts brown. Suranal plate triangular but blunt pointed, a non-chitinous crescent proximally.

Male:

Length of fore wings about 3.3 mm.

Marked as in female. Eyes small, only slightly larger than female. Antennæ stout. Terminal abdominal segments and genitalia symmetrical (Pl. XIV, Fig. 5), strongly chitinized, cap-like. The basal sclerite large, wide, fused narrowly to hypandrium proper. Distally is borne a pair of large, strong, inward directed lateral prongs and medianly a short truncate ridge with a short median tooth apically and arising at almost right angles to this tooth a large flat prong (not visible when viewed from below). The interval between the median piece and the lateral prongs angulate, nearly square. Parameres lying below hypandrium, independent, consisting of arms terminating in a swollen, talon-like part. Sense tubercles on paraprocts strongly elevated while from the mesal margin is produced the twisted flat upward-directed distal prong. Suranal plate roughly isosceles trapezoidal in shape, when viewed from above.

New York: Ithaca, Aug. 15, 1926, 5 ♀ on cliff wall, Aug. 22, 1926 1 ♀; Whetstone Gulf, Lewis Co., Sept. 2, 1926, 1 ♀; Riverhead, L. I., Oct. 1, 1926, 1 ♀.

Virginia: Spottswood, Oct. 4, 1926, 1 ♀ (C. & B.).

Ohio: Sandusky, July 22, 1926, 16 ♀, 10 nymphs, on trunk of elm tree in the city.

Illinois: Urbana, July 13, 1892, 20 ♀ (Hart), June 14, 1890, 2 ♂, July 1, 1888, 1 ♀, June 27, 1916, 1 ♀ (Hart) I. N. H. S.; Meredosia, Aug. 22, 1917, 11 ♀ on tree trunks. I. N. H. S.; Algonquin, June 18, 1890, 1 ♀, I. N. H. S.

Pennsylvania: Philadelphia 1 ♂ (S. F. Aaron). Holotype.
P. A. N. S.

***Psocus insulanus* new species**

Male:

Length of body 2.5 mm.

Length of fore wings 3.0 mm.

Golden brown markings throughout. An unmarked pair of lines on vertex due to a solid triangular brown area on epicranial suture and obscured dotted areas above eyes. Ocelli large, pigmentation blackish. A triangle of brown medianly on front. Clypeus indistinctly lined with a few broad brown lines with a darker line midway. Labrum brown, genæ unmarked. Antennæ pale brown. Eyes large dull bluish black.

Coxæ, most of plurae and tergal lobes concolorous—a light golden brown. Wings faintly fumose, unmarked. Pterostigma rather deep, subangulate, a greyish spot in inner angle. Veins pale golden brown throughout. In the holotype a short r-m cross-vein present.

Genitalia and terminal abdominal segments asymmetrical. The hypandrium jaw-like (Pl. XV, Fig. 23) and rather narrow. The distal portion triangular, consisting of a ridge, adorned with a series of teeth, one row containing about 8 teeth and a parallel one, three or four. To the right of this ridge the structure strongly chitinized, the left portion weakly chitinized. The parameres (Pl. XV, Fig. 8) asymmetrical and appear as figured, the distal pieces stout and strongly chitinized while the proximal portions are slender and weakly chitinized. The distal prong on paraprocts long and slender—but none the less stout—a conspicuous spine arises just above the point of origin of the distal prong. Suranal plate inclined to be five-sided, viewed from above, apex blunt.

New York: Wading River, L. I., 19 Sept., 1926. 1 ♂ Holotype.

***Psocus leidy* Aaron**

Psocus leidy Aaron. Acad. Nat. Sci. Phila. Proc. **38**: 15, Pl. 1, Fig. 2. 1886.

Psocus bilobatus Banks. Mus. Comp. Zool. Bul. **62**: 4, Pl. 1, Fig. 1, March, 1918 (♂).

Female:

Length of body 4.2–5.0 mm.

Length of fore wings 5.1–5.5 mm.

Length of antennæ 5.0–5.7 mm.

Ivory white, sparsely marked with dark brown or black and thinly covered with whitish hairs.

Head: dotted areas on vertex indistinct; a small irregular spot behind the eye and two larger irregular areas anterior of eye on front. Ocelli surrounded by a small black spot. A large, roughly circular, black area on the clypeus touching the posterior margin and extending to the center of the sclerite; clypeus further indistinctly marked by about 14 broad lines apparently radiating from the central half of the paler, anterior margin. Clypeolus white, labrum brownish black. Genæ unmarked except for a small dorsal black spot. Eyes of moderate size, deep black. Maxillary palpus dusky, paling at the joints, the apical segment much deeper colored. Antennæ slender, the first two segments yellowish white, the third brownish, and the remaining dark brown.

Thorax: A brownish or black spot above coxæ; on meso- and metathorax they are much larger, divided by the pleural suture. Another dark area is found subventrally on the mesothorax ahead of the coxæ. Tergal lobes shining black, sutures ivory. Legs ivory, each segment becoming progressively darker distally, the tarsal joints light brown. A distinct dark brown spot on the proximal end of the tibia and a similar smaller one inside, distally on the femur. Wings (Pl. XX, Fig. 12) hyaline, the most characteristic marking being a *large roughly circular, brownish or black spot centering on the point where vein M and Cu divide*—it is usually very small in the male. Pterostigma opaque, white; R_1 angulate; a brownish spot apically. The usual dark spot surrounding wing clasp and at end of cell 1A large. Hind wing unmarked. Veins dusky at base, brown distally, R_1 pale.

Abdomen: Coarsely and usually sparsely marked with dusky brown at the sutures, uniformly white below but occasionally striped. Subgenital plate (Pl. XIII, Fig. 4) roughly quadrate, large, strongly chitinated laterally; weakly chitinated median portion occupying about two-fifths of the piece. Egg-guide long and slender, gradually widening distally and ending in a non-chitinated pilose apex; this piece together with the socket-like structures on the margin of the subgenital plate form the inverted letter γ . Only the tip of the membranous portion of the egg-guide is visible, with the structures *in situ*, gonapophyses covering the wide crescent-shaped piece on each side. Ventral

gonapophyses long, very slender, each terminating in a sharp twisted prong embracing the apex of the egg-guide. Lateral gonapophyses large, uniformly weakly chitinized, white, decidedly cup-shaped, about as long as wide, the distal margin evenly rounded and beset with conspicuous hairs (a few hairs also on outer surface). Rami of dorsal gonapophyses relatively broad, gradually narrowing distally to end rather abruptly at the base of the weak but finely drawn out and pointed apex; mesally on the inner surface of this fleshy trough or scroll-like appendage (not visible with structure *in situ*) a large, irregular, fuscous area. The inner surface is also thickly set with minute spines. Sense tubercles on paraprocts black. Suranal plate white, triangular bluntly pointed and beset with hairs.

Male:

Length of body 3.7–4.2 mm.

Length of fore wings 5.0–6.0 mm.

Length of antennæ 6.0–7.0 mm.

Similar to female in markings, usually a little darker. Eyes very large and black. Antennæ stout, beset with stout hairs which are about three times longer than those on female. Wings as in female, except *the brownish or black spot where vein M_4 Cu fork much smaller*. In the darker specimens the wings are faintly fumose and R is dark.

Terminal abdominal segments and genitalia strongly chitinized, occupying distal half of abdomen. Viewed from the side the highly chitinized distal tergites broadly crescent shaped—the cephalic margin curved, the caudal one straight. Hypandrium (Pl. XV, Fig. 5) asymmetrical, the piece proceeds left of the center. On each side basally a pair of weakly chitinized lobes which are concave, disc-like; the left disc is nearly circular, the right one two times or more larger, ear-shaped. Laterally from the lobes arise three strongly chitinized crooked ridges, (the two on the right being close together) which fuse distally appearing to end in a blunt point, but the fused part arches sharply ventrally in a claw-like piece. On the right side of the median piece considerable of the weakly chitinized lateral part of hypandrium visible. The highly chitinized, broad, distal portion of the fused parameres projects above the apex of the

hypandrium. The basal part consists of a small plate from which arise the arms which soon fuse to give rise to the highly chitinized, broad, asymmetrical, crozier or hook-shaped distal part (Pl. XV, Fig. 16); the inner surface thickly beset with small tubercles. Paraprocts (Pl. XV, Fig. 15) clasper-like, exceedingly slender proximally, terminating in a mushroom-like part; tooth at lower margin broad basally; sense tubercle, and immediately adjoining field, black. Suranal plate somewhat quadrate, with a small blunt point distally.

New York: Hornell, Sept. 15, 1925, 8 ♀; Rock City, Sept. 16, 1925, 15 ♀, 2 ♂ solitary on trunks of maple and chestnut; Montour Falls, Sept. 21, 1924, 13 ♀, 1 nymph on trunks of trees; Painted Post, Sept. 15, 1925, 17 ♀, 5 ♂, on tree trunks; Stow, Sept. 17, 1925, 1 ♀ on trunk of ironwood; Sea Cliff, L. I., Sept. 6, 1925, 2 ♂ on dead oak branches; Ceres, Sept. 16, 1925, 3 ♀ on ironwood trunk; Hunter, Aug. 16, 1925, 1 ♂; Ithaca, Sept. 12, 1925, 6 ♀, 1 ♂, 1 nymph, on bark of ash, Oct. 2, 1925, 4 ♀, on sycamore, Oct. 10, 1924, 7 ♀ solitary on tree trunks, Sept. 12, 1926, 8 ♀, 5 ♂, 1 nymph, Sept. 6, 1926, 12 ♀, 19 ♂, (6 ♂ on dead poplar limbs, remainder associated with *P. purus* on bark of dead beech snag), Sept. 26, 1926, 9 ♀, 1 ♂, 2 nymphs, Sept. 3, 1894, 1 ♀, 1 ♂ (Banks) M. C. Z.; Clarksburg, Sept. 18, 1925, 1 ♀; Riverhead, Oct. 1, 1924, 1 ♀ on trunk of scrub oak; Geneseo, Sept. 20, 1925, 8 ♀, 1 ♂; Elmira, Oct. 1, 1925, 5 ♀ on ironwood; Richburg, Sept. 16, 1925, 2 ♀ on ironwood; Wellsville, Sept. 15, 1925, 3 ♀; Fairhaven, Sept. 7, 1924, 1 ♀ under loose stones associated with *P. purus*; Montour Falls, Oct. 7, 1924, 2 ♀ (C. R. C.); McLean Reservation, Grass Bog 3, Aug. 22, 1924, 1 ♂; Whetstone Gulf, Lewis Co., Sept. 2, 1926, 1 ♀; Michigan Mills, Lewis Co., Sept. 1, 1926, 10 ♀, 19 ♂, 3 nymphs on dead limbs; Parkers, Lewis Co., Sept. 2, 1926, 3 ♀, 1 ♂; Nigger Pond, Oswego Co., Sept. 3, 1926, 1 ♀, 4 ♂; Frecks, Aug. 19, 1926, 5 ♀, 2 ♂, 2 nymphs (S. C. Bishop); Haines Falls, Sept. 25, 1 ♀ (Banks) M. C. Z.; Moshulu, Oct. 4, 1 ♀ (Banks) M. C. Z.; Sea Cliff, L. I., Oct. 2 ♀, Aug. 1 ♀, July, 1 ♀ (Banks) M. C. Z.

Maine: Mt. Desert Island (Beech Mt.) Sept. 12, 1926, 3 ♂ (C. P. Alexander); Ft. Kent, Sept. 1910, 1 ♂ (C. W. Johnson) M. C. Z. Holotype of *Psocus bilobatus* Banks.

New Hampshire: Mt. Washington, 2 ♂ (Banks) M. C. Z.; Gorham, Aug. 3, 1868, 1 ♂, M. C. Z.; Franconia, 1 ♀ (Slosson) M. C. Z.

Massachusetts: Cambridge, Aug. 19, 1 ♂ (Banks) M. C. Z.

Rhode Island: 1 ♀, 1 ♂ (Dr. Leidy) P. A. N. S. Holotype and Allotype; 3 ♂, (Dr. Leidy) M. C. Z., 1 ♂ (O. Sacken) M. C. Z.

New Jersey: Riverton, Sept. 11, 1 ♂, M. C. Z.

Pennsylvania: Philadelphia, 2 ♀ (S. F. Aaron) P. A. N. S. part of type series; Pottstown, Aug. 8, 2 ♂ (Banks) M. C. Z.

West Virginia: Aurora, Aug., 2 ♀, 1 ♂ (Banks) M. C. Z.

District of Columbia: Washington, 1 ♀, 2 ♂ (Banks) M. C. Z.

Virginia: Falls Church, July 17, 1 ♂, July 27, 2 ♂, Aug. 2, 1 ♀, Sept. 1 ♀, 1 ♂, Oct. 20, 1 ♀ (Banks) M. C. Z.; Vienna, Oct. 2 ♀ (Banks) M. C. Z.

Wisconsin: Price County, Aug. 19, 1897, 1 ♀, M. C. Z.

Tennessee: Mill Creek, below falls, on Mt. Leconte, Oct. 10, 1926, 1 ♂, (C. & B.).

California: Blue Lake, July 27, 1927, 1 ♂ (J. D. Hood) beating mostly dead *Salix*.

In the vicinity of Ithaca during the last half of September and early October the females of this large, light colored species are commonly observed on the trunks of deciduous trees. At this time they occur singly; they have forsaken the gregarious habit common earlier. The females rarely fly but run rapidly a short distance, when disturbed, in that curious stumbling gait so characteristic of the order. The males fly readily. They disappear two weeks or more before the female. Collections made at weekly intervals at Ithaca, substantiate the belief that there is but one brood annually in this and localities northward.

***Psocus lichenatus* Walsh**

Psocus lichenatus Walsh. Ent. Soc. Phila. Proc. 2: 183. 1863.

This species related to *elegans* and the two distinct from other members of *Psocus* because of the shape of the head. The wing markings extensive, somewhat resembling *moestus* or *Lichenomima sparsa* Hagen. I have seen paratypes in the Museum of Comparative Zoology and at the Philadelphia Academy of Natural Sciences. Walsh writes: "Occurred in the autumn, on

some precipitous sandstone cliffs, in great numbers." I have never taken any of this species and have no record of any collections being made of it other than those by Walsh about 1863 in the vicinity of Rock Island, Illinois.

***Psocus lithinus* new species**

Female:

Length of body 3.35 mm. ave. of 8 individuals.

Length of fore wings 4.4 mm. ave. of 8 individuals.

Length of antennæ 3.8 mm. ave. of 8 individuals.

Head: Dotted areas on vertex light brown; ocelli involved in a blackish spot; two short, parallel lines medianly on front; clypeus lineated with narrow pale brown parallel lines; a spot in center of genæ; posterior half of clypeolus and all of labrum brown. Segments 1-3 of maxillary palpus whitish, distal segment brown. Antennæ brown. Eyes of moderate size.

Thorax: Tergal lobes shining brown; white area in sutures broad; a brown spot or line above coxæ which are pale brown. Tarsi brown. Wings (Pl. XX, Fig. 11) faintly fumose, unmarked. The pterostigma opaque with indistinct light brown stippling in the distal two-thirds or less; the cell only moderately deep, R_1 rounded. Veins light brown. M joined to R_s at a point or for a short distance. Hind wing unmarked.

Abdomen striped with dark grey; the pigment confined to tergites. Terminal segment and genital processes (Pl. XIII, Fig. 3) dark brown. Basal portion of the subgenital plate E-shaped, due to the presence of a pair of short, elongate, lateral plates and a straight slender median plate. The egg-guide arrow-shaped except the apex broad and rounded; a white non-chitinized median core widens at and includes the pilose apex. Ventral gonapophyses stout, with a lateral arch distally, apex sharp-pointed. Lateral gonapophyses rather small, cup-shaped, the slightly swollen proximal portion sparsely pilose. Dorsal gonapophyses of average proportions with the apex drawn out, sharp, the chitinized support lateral, and in two sections; near mesal margin an elongate fuscous area. Sense tubercles on paraprocts rather large, brown. Suranal plate triangular, basal half chitinized; apex blunt-pointed.

Male:

Length of body 3.2 mm. ave. of 7 individuals.

Length of fore wings 4.2 mm. ave. of 7 individuals.

Length of antennæ 4.0 mm. ave. of 7 individuals.

Eyes black, only slightly larger than those of female. Antennæ moderately stout, strongly pilose. Terminal segments and genital processes (Pl. XIV, fig. 16) dark brown, highly chitinized, cap-like; at first glance appearing to be symmetrical but upon closer examination the lateral pieces distally on hypandrium found to be asymmetrical. Basal sclerite of hypandrium relatively narrow, definitely fused midway to the triangular hypandrium

proper. Distally and medianly hypandrium produced into a large, swollen, rather weakly chitinized, bluntly pointed, hollow cone which points slightly inward; on each side and extending below this cone, a pair of curious, highly chitinized arms. The right arm visible throughout its length, extending slightly beyond the median cone; the outer margin and truncate apex, serrate. The left arm swollen at base, then bends sharply to the right, extending below the median prong, ending where it touches the right arm. (While not visible with the structures *in situ* the distal third of the dorsal margin of this arm also serrate.) Parameres independent, consisting of a pair of rather stout arms terminating in furcated inward and laterally pointing hooks. The rather large sense area covers most of the basal portion of paraproct; apical portion twisted; from the lower distal margin a moderate sized inward and upward pointing claw. Suranal plate trapezoidal, gently rounded distally.

New York: Ithaca, collections in 1926: July 11, 3 ♀, Aug. 6, 20 ♀, 5 ♂, 8 nymphs, Aug. 15, 11 ♀, 5 ♂, Aug. 22, 10 ♀, 3 ♂, Aug. 30, 2 ♀, Sept. 6, 4 ♀, Sept. 12, 3 ♀, Sept. 26, 3 ♀, 2 ♂, taken chiefly in the shade on moderately dry rock cliffs in Six Mile Creek or its tributaries. Some however were found under loose stones. Holotype (♂), Allotype, Paratypes. Ithaca, Sept. 12, 1925, 7 ♀, 1 ♂ under stones; McLean Reservation, July 31, 1926, 2 ♀, 1 ♂, 5 nymphs, under loose stones in a pile; Saratoga Springs, July 14, 1926, 5 ♀, 3 ♂, 3 nymphs, under stones in a stone wall; Penn Yan, Aug. 29, 1926, 1 ♀ on rock cliff in shade; Whetstone Gulf, Lewis Co., Sept. 2, 1926, 4 ♀, on rock cliff; Clarksburg, Sept. 18, 1925, 1 ♀; Hunter, Aug. 16, 1925, 5 ♀, 2 nymphs, under large stones; Sea Cliff, L. I., Sept. 6, 1925, 1 ♀, 1 ♂; Geneseo, Sept. 20, 1925, 1 ♀; Woodwardia Swamp, Tompkins Co., Aug. 10, 1924, 2 ♀, under loose stones; Montour Falls, Sept. 21, 1924, 2 ♀ on rock cliff.

***Psocus longipennis* Banks**

Psocus longipennis Banks. Mus. Comp. Zool. Bul. **62**: 3. 1918.
Male:

Length of fore wings 5.7 mm. ave. of 6 individuals.

Length of body 2.9 mm. ave. of 5 individuals.

Head: The spots in the usual position on the vertex, brown. Ocelli set in a dark tubercle of usual appearance, but vertex abruptly sunken just behind lateral ocelli. Clypeus distinctly

lined with rich brown, *somewhat fused at posterior margin and again fused into a pair of lateral spots near anterior margin*. Labrum brown. Genae with a median spot. Maxillary palpus pale or light brown; antennae (missing except for 3 or 4 basal segments) not strongly pilose. Eyes dull bluish black, not exceptionally large.

Thorax: Mostly dark shining brown throughout, paling at sutures. Legs pale, darkening distally. Wings (Pl. XX, Fig. 6) typically faint fumose. Pterostigma very long, shallow, rounded distally; R_1 rather pale. Veins stout, light brown; Rs and M joined at a point or for a short distance.

Abdomen: Coarsely striped with purplish brown on sides; a series of diamond-shaped spots on median line of dorsum. Terminal abdominal segments and genitalia symmetrical, dark brown (Pl. XIV, Fig. 2) and of the type represented by *quietus*. Basal sclerite of moderate depth and typical of this group. Hypandrium proper roughly triangular, viewed from below, and strongly convex. Distally arise three well-spaced prongs; the median one is the longest, triangular, yet rather slender, and truncate distally; the lateral pair strongly chitinized, sharp pointed, directed slightly mesally. The parameres, independent, arising a short distance above proximal margin of inner surface of hypandrium. These pieces become swollen distally, fork, and each part strongly curved and pointed; the more proximal hook has a small, narrowly attached plate at its apex. Paraprocts elongate, with the large brown sense area midway; the distal hook twisted, triangular. Suranal plate triangular, definitely chitinized except at the nearly truncate apex.

Colorado: Boulder, 30 Aug. 1899, 1 ♂, M. C. Z. Holotype. Denver, (Oslar) 1 ♂. In Cornell University Collection. Used for critical study. Agrees in every particular with holotype.

Wyoming: Mammoth Hot Springs, Yellowstone Park, 30 Aug. 1927, 9 ♂, (C. R. Crosby).

In addition to the 9 males of this species taken by Prof. C. R. Crosby at Mammoth Hot Springs, 5 females of *Psocus* sp. were also collected which apparently are *longipennis*. The writer hesitates to describe these females unqualifiedly as *longipennis*

because of the small size of their wings (also shape of pterostigma) and differences in wing and abdominal markings. The only members of *Psocus* taken at Mammoth Hot Springs on Aug. 30, however, were these fourteen individuals. Head markings agree with the male; these are usually much more constant in the sexes than abdominal ones. Male genitalia of *longipennis* are very similar to *quietus* and *subapterous* n. sp. The females here discussed have genitalic structures practically identical with *oregonus* and *subapterous* n. sp. and similar to *quietus* and *subquietus* n. sp. These four species form a group remarkable for the small differences in genitalic structures of males and the even slighter differences in females. One might conclude, therefore, that females of *longipennis* would probably have genitalia of the *quietus* type.

Female: (*macropterous*)

Length of fore wings 3.6 mm. ave. of 4 individuals.

Length of body 3.2 mm. ave. of 4 individuals.

Agrees with male in markings, paler; abdomen splotted with purplish grey, faded above; eyes about one-third smaller. Wings subhyaline, with two wide fumose bands. *Pterostigma* of moderate length and depth, rounded; a fumose band including distal two-thirds of pterostigma, thence across to cell Cu_1 ; wing distal to this band, slightly fumose; a wide band proximal to junction of M and Rs. Veins coarse, light brown.

Female: (*brachypterous*)

Length of fore wings 2.5 mm.

Length of body 3.4 mm.

Differs from *macropterous* forms in being deeper colored throughout and of course by the reduced wings.

Wyoming: Mammoth Hot Springs, Yellowstone Park, 30 Aug. 1926, 5 ♀ (1 *brachypterous*). Allotype.

This case and that of *subapterous* are the only known examples of reduced wings in American *Psocus*.

***Psocus maculosus* (Banks)**

Myopsocus maculosus Banks. Am. Ent. Soc. Trans. **34**: 258. 1908.

Male:

Length of fore wings 3.8 mm.

This species closely related to *moestus*; the markings of body and wings (Pl. XX, Fig. 28) very similar. The genitalia, while showing a striking similarity to *moestus*, differs as follows: the left part of the median pieces on hypandrium (Pl. XV, Fig. 12) greatly reduced, appearing merely as an inconspicuous notch at the base of the right piece. The right piece broader except at the apex, longer and more crooked than the corresponding piece in *moestus*. The parameres (Pl. XV, Fig. 13) also similar to *P. moestus* but distally a former bipartite condition indicated by the slightly forked condition.

California: Berkeley, June, 1 ♂. Holotype M. C. Z.

A paratype (♂) was kindly supplied by Nathan Banks for critical study.

***Psocus moestus* Hagen**

Psocus moestus Hagen. Syn. Neuropt. N. A. p. 11. 1861.

Female:

Length of body 2.5 mm.

Length of fore wings 3.3–3.6 mm.

Head: Dead sulfur yellow above, dotted area on vertex faint; ocelli surrounded by black; brownish ring around base of antenna. Clypeus lineated with about sixteen broken brownish lines radiating from a central point on the anterior margin (lines much more distinct anteriorly). Clypeolus light brown, labrum almost completely covered by a larger brownish spot. Eyes phosphorescent, bluish green. Second and apical segment of maxillary palpus fuscous, others whitish, but in other individuals all segments uniformly fuscous. Antennæ short, rather stout, clothed with relatively long hairs, pale brown.

Thorax: Pleuræ brownish. Mesopresentum and several large spots on metaseutum light brown, remainder dull greenish yellow. Tibia rather pale except distally, remainder of leg segments brown. Wings (Pl. XX, Fig. 9) *largely covered with numerous small brown spots*. Some of the spots merge to form larger areas especially at base of pterostigma and where M and

Cu divide. Veins for most part pale, darker apically. M touches Rs at a point but no long cross-vein. Hind wing hyaline, unmarked except for a very few pale brownish spots distally in cell 1A and on costal margin near apex of wing.

Abdomen: Whitish above, almost uniformly dull brownish below; stripes on side at sutures, brown, widening ventrally. Base of subgenital plate consisting of a pair of large nearly square plates (Pl. XIII, Fig. 2). Egg-guide rectangular almost three times longer than wide, truncate, with apex non-chitinized, pilose; center of process less highly chitinized. Ventral gonapophyses of usual shape. Lateral gonapophyses cup-like, broad, short and rather large; proximal half strongly chitinized, and where chitinization ends a regular row of hairs; apical portion white, non-pilose. Dorsal gonapophyses broad at base, dorsal side drawn out into a very sharp point; rami extend well to apex. Sense tubercles on paraprocts large, only slightly raised, brown. Suranal plate pale brownish, triangular.

Male:

Length of body 2.5 mm.

Length of fore wings 3.3 mm.

Markings as in female; eyes larger. Antennæ stout with long hairs which are two or three times longer than those on female.

Abdomen not as deeply colored as female. Ventrally on each side, a circular fuscous spot back of the genital processes. Terminal segments and genitalia (Pl. XV, Fig. 18) asymmetrical. Hypandrium jaw-like, with a pair of strongly chitinized slender median pieces: the one on left, a stout, blunt pointed, unattached prong; the right one a slender ridge on each side of which are membranes which form a cap to enclose the parameres. Parameres fused, somewhat diamond-shaped, but more than twice as long as wide; the apex a single flat blade. Sense tubercles brown, only slightly elevated; paraprocts with the distal portion slender, curved upward and a strong, dorsally pointing prong arising from the ventro-apical surface. Suranal plate short, roughly quadrate.

New York: Ithaca, Sept. 26, 1926, 1 ♀, Sept. 5, 1926, 1 ♀, Oct. 7, 1926, 1 ♀ (Chester Rea), Aug. 6, 1926, 2 ♀; Stow, Sept. 17,

1925, 5 ♀ 1 ♂, on tree trunks; Clarksburg, Sept. 18, 1925, 1 ♀; Wellsville, Sept. 15, 1925, 3 ♀; Riverhead, Oct. 1, 1924, 6 ♀ 3 ♂ on bark of oak; Hornell, Sept. 15, 1925, 4 ♀; Hall, July 30, 1924, 1 ♀ indoors; Painted Post, Sept. 15, 1925, 11 ♀ 4 ♂; Parkers, Lewis Co., Sept. 2, 1926, 1 ♀; Michigan Mills, Lewis Co., Sept. 1, 1926, 5 ♀ 3 ♂; Saratoga Springs, July 14, 1926, 1 ♀ 2 ♂ on trunk and live branches of oak; Sea Cliff, L. I., Aug. 1 ♀ (Banks). M. C. Z.

Virginia: Caret, Oct. 28, 1926, 1 ♀ (C. & B.); Falls Church, July 17, 1 ♀, Sept. 24, and 29, 6 ♀ 3 ♂ (Banks) M. C. Z.

Maine: Beach Mt., Mt. Desert Is., Sept. 12, 1926, 1 ♂ (C. P. Alexander).

New Hampshire: High Island, July 1, 1 ♀ (Banks) M. C. Z.

Georgia: Dalton 1859, 1 ♀ (Sacken) M. C. Z. Holotype.

***Psocus montivagus* new species**

Female:

Length of body 3.5 mm. ave. of 9 individuals.

Length of fore wings 4.35 mm. ave. of 9 individuals.

Length of antennæ about 3.8 mm.

Close to *confraternus* with which it agrees in markings of body and wings, size, and color of eyes. This species is somewhat lighter in coloring.

The subgenital plate and egg-guide (Pl. XII, Fig. 2) differ from *confraternus* as follows: the lateral plates are widely separated, inclined to be longer than wide; strips along distal margin slender, strongly curved; medianly, roughly rectangular prolongation cephalad from base of egg-guide (this usually serves to separate the females from *confraternus*). The egg-guide, while very similar, shows the termination of the highly chitinated basal portion slightly forked, and the egg-guide is not constricted at this point.

Male:

Length of body 3.4 mm. ave. of 12 individuals.

Length of fore wings 4.3 mm. ave. of 12 individuals.

Length of antennæ about 3.8 mm.

Eyes only slightly larger than the female, which character serves to separate the males of this species from *confraternus*.

The genital processes differ from *confraternus* as follows: The median prong arising distally on hypandrium curves strongly cephalically but is *forked apically* (Pl. XIV, Fig. 11) the mesal and dorso-lateral lines form right angles, the distal portion of parameres shell-like (Pl. XIV, Fig. 7) slender; the pair of prongs arising laterally from hypandrium inclined to be flattened, so that the overlapping of the short lateral piece is visible in positions where this would not show in *confraternus*.

New York: Whetstone Gulf, Lewis Co., Sept. 2, 1926, 8 ♀ 12 ♂ on dead hemlock and pine limbs, Holotype, Allotype, Paratypes; Michigan Mills, Lewis Co., Sept. 1, 1926, 12 ♂ on dead hemlock and spruce limbs; Parkers, Lewis Co., Sept. 2, 1926, 6 ♀ 14 ♂ on dead hemlock and spruce.

***Psocus novæscotiæ* Walker**

Psocus novæscotiæ Walker. Cat. Neurop. Brit. Mus., p. 485. 1853.

Psocus contaminatus Hagen. Syn. Neurop. N. A., p. 10. 1861.

Psocus perplexus Walsh. Acad. Nat. Sci. Phila. Proc. **14**: 361. 1862 (♂).

Psocus cratægi Hagen (Mss. name of Asa Fitch). Verh. zool-bot. Ges. Wein **16**: 213. 1866.

Psocus hageni Banks. Ent. Soc. Wash. Proc. **6**: 202. 1904.

Female:

Length of body 5.0–5.5 mm.

Length of fore wings 5.5–6.5 mm.

Length of antennæ 6.7–7.5 mm.

Head: Dotted areas of vertex indistinct, obscured laterally by a pair of large fuscous spots; a pair of elongate fuscous spots touch lateral ocelli; the front bears a median V-shaped mark, and a pair of lateral spots; clypeus clouded with fuscous medially, incompletely lineated with about fourteen lines which fade anteriorly. Clypeolus and labrum unmarked. Palpus pale, last segment fuscous, becoming pitchy apically. Antennæ slender dark brown except segments 1, 2 and proximal half of 3, light brown.

Thorax: Tergal lobes shining black; on mesothorax in some individuals are distinguishable a series of four roughly circular blackish spots as in *purus*; pleuræ with a few touches of fuscous. Legs pale, tarsal joints brown; femora with a distal, inner, fuscous spot. Wings (Pl. XX, Fig. 5) hyaline, variously marked with fuscous or brown; markings range from an almost unmarked condition, exclusive of pterostigma, to individuals with a distinct broad band bordering the outer margin of the wing and other large spots. Pterostigma deep, R_1 angulate; pigment ranging from dark brown to light fawn. An elongate spot just

below inner angle of pterostigma. The following spots varying in size and intensity may be found: at fork of R and base of pterostigma, in cell R_5 behind furcation of Rs continuing over to cell M; in certain individuals a broad band borders the outer margin of wing ranging to those where all indications of a band are absent; at apex of cell 1A; in cell Cu at furcation of MCu and below in cell 1A—these two spots often join. Veins distinct, dark brown, pale proximally. Hind wings hyaline, unmarked.

Abdomen coarsely and irregularly marked above with fuscous, laterally marked at sutures, frequently fading out below. Terminal segments and genitalia (Pl. XII, Fig. 13). From the 7th sternite arises a small triangular piece which is notched distally whence it bends abruptly cephalicly and becomes attached to the triangular base of the egg-guide. Egg-guide elongate, white, beset with short hairs, evenly rounded at apex, supported medianly and laterally by chitinated prolongation from the base. The lateral pieces extend less than half the length of the structure while the median one, fully three-fourths the length. Viewed from the side the egg-guide becomes thickened apically. Ventral gonapophyses very long and slender terminating in a twisted sharp prong. Lateral gonapophyses broad, short, cup-shaped and covered with long hairs. Dorsal gonapophyses very large and very fleshy terminating in a short knob-like apex; visible rami strong and appearing to end midway on the lateral margin, but caustic potash specimens disclose an h-shaped (if looking at left gonapophyses) continuation which extends mesally and then distally, ending near the apex. Sense tubercles on paraprocts pure white, surrounded by black; apical part of paraprocts elongate, slender. Suranal plate white, triangular, supported laterally by chitinated pieces which end midway. Male:

Length of body 3.5–4.0 mm.

Length of fore wings 5.5–6.0 mm.

Length of antennæ 6.5–7.0 mm.

Markings similar to female, usually much deeper colored, especially on head, above. Eyes large, black. Antennæ fairly stout, clothed with hairs which are 2 or 3 times longer than

on female and in greater number. Wings slightly fumose. Pterostigma showing the same variation in the amount and intensity of brown pigment as found in female. Spots on remainder of wing usually *paler and more often absent* (Pl. XX, Fig. 4).

Hypandrium (Pl. XV, Fig. 9) with the distal part consisting of two asymmetrical pieces joined distally by a slender arm, intermediate part transparent. Left piece broadly crescent-shaped with an evenly rounded convex surface which is thickly set with short tubercles. Right piece resembles a triangular prism in shape; the mesal surface undulated, leaf shaped, lateral and distal margin serrate each bearing from five to seven teeth. Basal margin of lateral surface also inclined to be serrate. Parameres asymmetrical, consisting of two slender wide-spread arms which fuse distally, the apical portion blade-like, gradually narrowing to the notched apex. Paraprocts clasper-like with long attachment arms, terminating in a foot-like part bearing the much elevated sense tubercles at the "heel"; a very long, dorsally pointing claw arises from the lower margin. Posterior margin of suranal plate produced laterally into curious bulb-like areas, similar to the sense tubercles on the paraprocts; the plate is quadrate.

New York: Ithaca, Sept. 12, 1925, 4 ♀ 3 ♂ 1 nymph, on trunk of poplar, Sept. 26, 1926, 3 ♂ 2 nymphs, on dead poplar and sycamore limbs, June, 1 ♀ (Banks) M. C. Z., July 29, 1897, 1 ♀ (Banks) M. C. Z.; Michigan Mills, Lewis Co., Sept. 1, 1926, 20 ♀ 7 ♂ on dead or shaded limbs of hemlock, spruce, and deciduous trees; Painted Post, Sept. 15, 1925, 1 ♀; Parkers, Lewis Co., Sept. 2, 1926, 1 ♂; Chapel Pond, Essex Co., July 19, 1925, 3 nymphs (S. C. Bishop); Long Pond, Suffolk Co., Sept. 19, 1926, 1 ♂; Artists Lake, Suffolk Co., Sept. 19, 1926, 3 ♀ 3 ♂ 2 nymphs on dead and dying limbs of larch; Lake Placid, Aug. 12, 1904, 1 ♂ (E. P. VanDuzee) M. C. Z.; Moshulu, Oct. 18, 1902, 1 ♀ (Banks) M. C. Z.; Sea Cliff, L. I., 2 ♀ 2 ♂ (Banks) M. C. Z.

Nova Scotia, Canada: Digby Co., Aug. 1917, 1 ♀ M. C. Z.

Maine: Southwest Harbor, Mt. Desert Island, Aug. 31, 1926, 1 ♀ 2 ♂ (C. P. Alexander); Beech Mt., Mt. Desert Island, Sept. 12, 1926, 2 ♀ (C. P. Alexander); Greene, Aug. 26, 1925, 1 ♂ (C.

R. C.) ; 1860, 1 ♀ (P. R. Uhler) M. C. Z. ; West Beach, 1 ♀ M. C. Z.

New Hampshire: Franconia, 1 ♂ M. C. Z.

Massachusetts: Beverly, Sept. 9, 1869, 1 ♂ M. C. Z. ; Boston, June, 1877, 1 ♀ (J. P. B. N.) M. C. Z. ; Waltham, July 15, 1864, 1 ♀ (P. R. Uhler) M. C. Z. ; Wellesley, Sept. 15, 1904, 1 ♀ (A. P. Morse) M. C. Z.

Rhode Island: Newport, Sept., 1 ♀ M. C. Z.

Maryland: Plummers Island, Sept. 28, 1903, 1 ♀ (Heidman) M. C. Z. ; Sept. 9, 1 ♂ (Banks) M. C. Z. ; 1 ♀ (P. R. Uhler) M. C. Z. Type of *P. contaminatus* Hagen and *P. hageni* Banks.

West Virginia: Aurora, Aug., 1 ♀ 1 ♂ (Banks) M. C. Z.

Virginia: Falls Church, June 28, 1 ♂, Aug. 27, 1 ♂, Sept. 16, 1 ♀, Oct. 13, 1 ♀ (Banks) M. C. Z. ; Delphone, Sept. 10, 1 ♀ (Banks) M. C. Z. ; Boykins, June 10, 1895, 1 ♀ (Banks) M. C. Z.

District of Columbia: Washington, 1854, 1 ♀ (O. Sacken) M. C. Z. Type of *P. contaminatus* Hagen and *P. hageni* Banks.

Illinois: Rock Island, 1860, 1 ♂ Paratype (?) *P. perplexus* Walsh, 1864, 1 ♂ (B. D. Walsh) M. C. Z.

North Carolina: Greensboro, June 1901, 1 ♀ (F. C. Fratt) M. C. Z.

Kentucky: Quicksand, June 25, 1925, 3 nymphs.

Georgia: Tallulah Falls, Oct. 18, 1926, 1 ♂ (C. & B.) ; Tiger, Oct. 18, 1926, 1 ♀ (C. & B.).

Florida: Monticello, Jan. 26, 1914, 1 ♂ M. C. Z. ; Marion Co., 3 miles S. W. of Micanopy, May 9, 1926, 1 ♀ (T. H. Hubbell). Sweeping in low hammock.

The remarkable color variation found in *Psocus novaescotiae* Walker, particularly in the wings, has caused earlier workers to designate certain of the extremes as distinct species. A critical examination of the male and female genitalia of variously marked individuals shows clearly that they are one species. *Psocus contaminatus* Hagen, renamed *Psocus hageni* by Banks, is, as an examination of the types disclosed, the form having a broad band bordering the outer margin on the fore wing. The type of *Psocus perplexus* Walsh is non-existent, but specimens

sent Dr. Hagen apparently labelled *Psocus perplexus* in Walsh's hand writing are the form with nearly unmarked wings. All gradations in wing markings between these extremes occur. The species is widely distributed, and no color form appears to be confined to a given locality.

P. novaescotiae is found on tree trunks or on dead and dying limbs. It is not infrequently associated with *Psocus leidyi*.

Psocus oppositus Banks

Psocus oppositus Banks. N. Y. Ent. Soc. Jour. **15**: 165. 1907.

Psocus interruptus Banks. Mus. Comp. Zool. Bul. **64**: 306, Pl. 2, Fig. 15. Oct. 1920.

Female:

Length of body 3.2 mm. ave. of 6 individuals.

Length of fore wings 3.7 mm. ave. of 6 individuals.

Length of antennæ 3.6 mm. ave. of 3 individuals.

Head: Dotted areas on vertex light brown; a blackish nearly triangular spot involving ocelli, extending over front to clypeus; clypeus bears about six complete lines medianly, while laterally there are broken, short, horizontal lines; genæ unmarked; some clouding at base of maxillary palpus; posterior half of clypeolus and all of labrum brown. Eyes dull black. Antennæ brown, pale proximally.

Thorax: Tergal lobes shining dark brown, sutures whitish; sides mostly brown, legs pale brown. Wings (Pl. XX, Fig. 20) hyaline, marked with two shades of brown. Pterostigma deep, R_1 angulate or subangulate; a dark brown spot involves about the distal two-thirds and extends below R_1 . A characteristic dark brown spot involving all, or less, of cell M extending into cell Cu_1 , where it may barely encroach or cover nearly half of the cell; a light brown spot between this and the spot in pterostigma suggests a band. Another band but of light brown extends from base of R_s to end of cell 1A; proximal to this band an irregular spot on vein M Cu . Veins brown; cross-vein r-m present or not. Cell M narrow. Hind wing hyaline touched faintly with brownish.

Abdomen: Dirty white, striped with brownish grey. Subgenital plate (Pl. XIII, Fig. 13) composed of a pair of small,

irregular, elongate, widely separated lateral plates which are connected medianly by a slender inverted V-shaped portion from the apex of which arises the rectangular egg-guide. Egg-guide consists of a rectangular distal portion with a chitinized "core" and a narrow non-chitinized border; proximally a pair of lobe-like plates. Ventral gonapophyses slender, fairly straight. Lateral gonapophyses with a swollen, pilose, proximal portion, while the distal part non-pilose and drawn out strongly laterally. The dorsal gonapophyses characterized by a definite mesal direction to the pointed apex; the rami in two narrowly connected sections, the lateral margin of the strongly chitinized proximal portion undulated—bearing three ridges. Sense tubercles of paraprocts large, light brown. Suranal plate strongly chitinized, triangular.

Male:

Length of body 2.6–2.7 mm.

Length of fore wings 3.2–3.5 mm.

Length of antennæ about 4.2 mm.

Marked as in female, possibly darker. Eyes a little larger. Antennæ very stout, strongly pilose.

Terminal abdominal segments and genitalia symmetrical (Pl. XIV, Fig. 20), dark brown, highly chitinized, cap-like. The lateral margin of the hypandrium proper, strongly chitinized and deeply notched midway; distal half of the piece more highly chitinized, swollen, terminating in a dorsally pointing prong. Embracing this median prong a pair of longer, slender, curved, lateral prongs. Viewed from the rear this group of prongs suggest the letter W. Parameres arm-like and arising near the base of the hypandrium; the distal third of each drawn out into a long slender prong. Paraprocts elongate, sense tubercles large, brown; arising from mesal margin distally a rather short triangular tooth. Suranal plate short, broad, gently rounded apically.

New York: West Barre, Sept. 19, 1925, 1 ♂ beating dry leaves; Artists Lake, Suffolk Co., Sept. 19, 1926, 2 ♀ 1 ♂ on dead larch limbs; Long Pond, Suffolk Co., Sept. 19, 1926, 1 ♀.

Virginia: Falls Church, Sept., 1 ♀ (Banks) M. C. Z. Holotype. London Bridge, Aug. 25, 1929, 2 ♀.

South Carolina: Sumter, Oct. 20, 1926, 2 ♀ (C. & B.).

Florida: Gainesville, Mar. 12, 1926, 1 ♀ (Hubbell); Lake Worth, 1 ♀, M. C. Z. Holotype *P. interruptus* Banks.

***Psocus oregonus* Banks**

Psocus oregonus Banks. Am. Ent. Soc. Trans. **26**: 239. 1900.

Psocus californicus Banks. Am. Ent. Soc. Trans. **32**: 2. 1905.

Female:

Length of fore wings about 3.8 mm.

Pale orange marked with brown.

Head: Dotted areas on vertex distinct; *arms of the epicranial suture touch clypeus*. Clypeus lineated with brown parallel line; labrum brown; genæ clouded with brown. Eyes dull, black.

Thorax: Tergal lobes shining, brown; wings sub-hyaline, sparsely marked with brown. Pterostigma opaque; a brown spot covering distal two-thirds, the cell is of moderate depth, subangulate. An incomplete band from base of pterostigma to end of cell 1A (the pigment in this band is practically confined to a broad margin on each side of the veins in its course). Veins proximal to this band incompletely margined with brown, M joined to Rs by a short cross-vein or not.

Terminal abdominal segments and genitalia show relationship of species to the "*quietus*" group. Basal part of subgenital plate inverted V-shaped (Pl. XIII, Fig. 11), the egg-guide large, uniformly chitinized, arrow-shaped, its side convex, and the apex blunt pointed, weakly chitinized and pilose. Ventral gonapophyses with a sharp, twisted apex. Lateral gonapophyses produced mesally into a narrow portion; the structure short, wide, chitinized proximally and there pilose. Dorsal gonapophyses bears a chitinized, pointed apex and a fuscous yoke along distal margin below apex. Sense tubercles on the rather short paraprocts large. Suranal plate triangular with a narrow non-chitinized crescent proximally; apex swollen, non-chitinized.

Oregon: Divide, Sept. 12, 1 ♀. Cottage Grove, Sept., 1 ♀. Supplied by N. Banks for critical study.

California: Claremont, 1 ♀ (Baker). Holotype of *P. californicus* M. C. Z.

***Psocus persimilis* Banks**

Psocus persimilis Banks. Am. Ent. Soc. Trans. **34**: 257. 1908.

Male:

Length of fore wing about 3.5 mm.

Dull white marked with brown. Head with the usual dotted areas on vertex; front brown mesally; clypeus lineated with moderately broad parallel lines; genae unmarked; posterior half of clypeolus and nearly all of labrum brown. Eyes dull black, very large.

Thorax: Tergal lobes shining brown. Wings hyaline. Pterostigma of moderate depth, R_1 rounded; an elongate brown spot in the cell and extending below R_1 , a brownish area at end of cell 1A. Veins stout, brown.

Terminal abdominal segments and genitalia (Pl. XIV, Fig. 17) symmetrical, strongly chitinized, cap-like. Hypandrium proper, when viewed from below, equilateral triangular in shape. Basal sclerite similar to other members of this group. The distal portion produced medianly into a swollen ridge. Lateral margins strongly chitinized, distal three-fifths twisted and lying in back of, and terminating before the apex, a short twisted piece. Distally the hypandrium then exhibits a blunt, weakly chitinized narrow termination of the median ridge, the lateral pieces evenly rounded, highly chitinized extending to a point in line with the apex of the median ridge. Paraprocts stout, bearing medianly the large sense area and terminally a flat, triangular, dorsally pointing hook. Suranal plate short, triangular, with blunt apex.

Texas: Brownsville, 3 ♂ Holotype and Paratypes. A paratype kindly supplied by Nathan Banks for critical study of genitalia.

***Psocus petiolatus* Banks**

Psocus petiolatus Banks. Mus. Comp. Zool. Bul. **62**: 4. March, 1918.

Female:

Length of body 3.15 mm. ave. of 9 individuals.

Length of fore wings 4.2 mm. ave. of 9 individuals.

Length of antennæ about 3.8 mm.

Similar to *confraternus* in markings, lighter; on the abdomen the markings have a different distribution and are brownish or blackish. Eyes of moderate size, dull deep blue. Antennæ rather stout, brown, paling proximally.

Wings (Pl. XX, Fig. 27) hyaline or subhyaline, sparsely marked with several brown spots. Pterostigmal marking and shape of cell as in *confraternus* except R_1 evenly rounded with no indication of an angle. Faint indication of band from base of pterostigma to end of cell 1A. Veins dark, R_1 often dark, r-m shorter than in *confraternus*.

Abdomen with a large brownish black dorsal saddle which narrows and ends midway on the sides; a large triangular purplish brown area on sternum at subgenital plate extending cephalically to middle of abdomen. Genital processes similar to *confraternus*, the subgenital plate and egg guide (Pl. XII, Fig. 6) differ as follows: the shape of the lateral plates; the characteristic straightness of the strongly chitinized distal strip; and the shape of the egg guide.

Male:

Length of body 2.9 mm. ave. of 14 individuals.

Length of fore wings 3.7 mm. ave. of 14 individuals.

Length of antennæ about 3.7 mm.

Similar to female in markings, darker. Antennæ stout, dark. Eyes only slightly larger than female. On the wings, vein R_1 usually quite dark.

The genital structures similar to *confraternus* and *montivagus* differing in that the three distal lobes on hypandrium are much flattened (Pl. XIV, Fig. 18). The median structure is short, curving only slightly cephalically (Pl. XIV, Fig. 10); viewed from below the sharp-pointed apex readily visible; the median prong and its basal portion are so completely one that a triangle is formed, with the vertex the termination of the piece; the lateral margins are nearly straight, with only a slight constriction midway. The lateral lobes flat, showing clearly from below their two-pieced condition (the thin dorsally curved inner piece, supported laterally by a strong overlapping piece which ends halfway). The parameres (Pl. XIV, Fig. 9) as in *confraternus* but the distal parts only slightly concave.

New York: Whetstone Gulf, Lewis Co., Sept. 2, 1926, 1 ♀ 6 ♂ on dead hemlock; Hudson, July 15, 1926, 1 ♀; Ballston Lake, July 14, 1926, 1 ♂, taken in beating dead oak and pine limbs; Geneseo, Sept. 20, 1925, 2 ♀ on dead oak limbs; Sea Cliff, Sept. 6, 1925, 1 ♂; Parkers, Lewis Co., Sept. 2, 1926, 1 ♂.

Indiana: Tremont, July 24, 1926, 1 ♂ (Sand Dunes).

Tennessee: Bristol, Oct. 5, 1925, 4 ♀ 6 ♂ (C. & B.) taken at light of Coca-cola stand.

Virginia: Falls Church, 30 June, 1 ♀ (Banks) M. C. Z. Holotype.

Psocus pollutus Walsh

Psocus pollutus Walsh. Acad. Nat. Sci. Phila. Proc. **14**: 361. 1862.

Female:

Length of body 2.9–3.2 mm.

Length of fore wings 3.7–4.1 mm.

Length of antennæ 3.4–3.8 mm.

Head: Whitish with the usual dotted areas on vertex, brown; a pair of spots touching lateral ocelli; a V-shaped mark medianly on front and a pair of lateral spots; genæ white, margined with brown and with a median brown spot; clypeus broadly lineated with brown—the distinctness of the lines varying considerably—and bearing a distinct cross which divides the clypeus into four almost equal areas. (This cross is distinct even in nymphs and teneral adults.) Posterior half of clypeolus brown. Maxillary palpus brown; segments becoming progressively darker. Eyes phosphorescent bluish green. Antennæ rather stout, light brown, segments 1–3 pale.

Thorax: Whitish areas above coxæ, pleuræ incompletely marked with brown. Tergal lobes brown, margined and bisected with white or pale brown. Legs pale, femora bearing a dark spot distally below, tarsi brown. Wings (Pl. XX, Fig. 18) hyaline, marked conspicuously with brown bands and spots. Pterostigma opaque, moderately deep, R_1 subangulate; a spot of variable size in distal half of cell; a smaller spot just below R_1 continuing the pterostigmal spot. Wing otherwise marked by: an irregular band extending from base of pterostigma to cell 1A;

base of wing especially at veins faint brownish; basal two-thirds of cell 2A, brown; about three small spots proximally in cell R_5 ; a broad band borders outer wing margin but the pigment attains wing margin only at end of veins. Veins brownish—except R_1 which is white—paling proximally with or without r-m cross-vein. Inner and costal wing margin of hind wing faintly clouded with brown, otherwise hyaline.

Abdomen irregularly and variously marked with brown mixed with purple and grey. Terminal segments and genitalia (Pl. XIII, Fig. 6). Proximal portion of subgenital plate consisting of a pair of small irregular plates. The base of the egg-guide arrow-shaped, as in related forms, but distally the structure widens and is almost truncate; the egg-guide uniformly chitinized except at apex and there a row of five or six strong hairs—a conspicuous one on each side of a median notch in the chitinization. Ventral gonapophyses very slender, short. Lateral gonapophyses white, cup-shaped with the distal portion lobe-like and extending behind the dorsal gonapophyses; a row of hairs divides the basal third from the non-chitinized apical portion. Dorsal gonapophyses with a long, drawn out, bent point. Sense tubercles on paraprocts dark brown. The evenly rounded distal margin of the suranal plate bears a series of seven conspicuous hairs: a short median one, with a pair on each side of equal length, laterally two pairs of much longer ones.

New York: Michigan Mills, Lewis Co., Sept. 1, 1926, 9 ♀, on both dead and living hemlock and spruce limbs; Parkers, Lewis Co., Sept. 2, 1926, 21 ♀, chiefly on dead spruce and hemlock limbs; Whetstone Gulf, Lewis Co., Sept. 2, 1926, 11 ♀, on dead hemlock; Nigger Pond, Oswego Co., Sept. 3, 1926, 2 ♀; McLean, July 31, 1926, 17 ♀, 4 nymphs, on dry hemlock boughs in shade; Artists Lake, Suffolk Co., Sept. 19, 1926, 2 ♀; Geneseo, Sept. 20, 1925, 1 ♀, on tree trunk.

Maine: Southwest Harbor, Mt. Desert Island, Aug. 31, 1926, 2 ♀ (C. P. Alexander); Beech Mt., Mt. Desert Island, Sept. 12, 1926, 1 ♀ (C. P. Alexander).

New Hampshire: Gorham, 1868 (Hagen) 1 ♀, M. C. Z.

Massachusetts: Auburndale, Sept. 22, 1907, 1 ♀ (C. W. Johnson), M. C. Z.

Maryland: Chesapeake Beach, June 18, 1914, 1 ♀ (L. O. Jackson), M. C. Z.

Virginia: Falls Church, July 3, 1 ♀, Oct. 10, 2 ♀ (Banks), M. C. Z.; Delaplane, Sept. 10, 1 ♀ (Banks), M. C. Z. London Bridge, Aug. 25, 1929, 3 ♀.

Illinois: Rock Island, 1864, 1 ♀ (Walsh), M. C. Z. Paratype (?).

Psocus purus Walsh

Psocus purus Walsh. Acad. Nat. Sci. Phila. Proc. **14**: 361. 1862.

Psocus lucidus Harris. Ent. Corresp., p. 328. 1869.

Psocus genualis Banks. N. Y. Ent. Soc. Jour. **11**: 236. 1903.

Female:

Length of body 4.3–4.8 mm.

Length of fore wings 5.0–5.6 mm.

Length of antennæ 6.0–6.8 mm.

Generally ivory white, marked with black and fuscous.

Head: Two large elongate fuscous spots on vertex; a small one completely surrounding ocelli; another large roughly circular one on clypeus touching the posterior margin; genæ unmarked; clypeus faintly lineated; labrum coarsely touched with fuscous. Eyes black. Maxillary palpus white, terminal segment dusky at tip. Antennæ very slender, first three segments pale; median ones deep brown, apical ones paling.

Thorax: Markings on pleuræ indistinct. Tergal lobes irregularly covered with shining black; white areas between lobes broad; on tergum of metathorax four black spots arranged in a curved transverse series, lateral spots larger. Legs pale, tarsi fuscous. Above, proximally on tibia, a black spot; one distally, above on femur. Probably the most characteristic marking (Pl. XX, Fig. 2) occurs on vein R_1 which is white for half its length, then dark brown in the distal half; the change occurs before the inner angle of the pterostigma. Veins conspicuous, brown, paling proximally. The wing entirely hyaline except for a faint fuscous area in cell R_5 behind R_s furcation; a dark spot at wing hooks located at base of pterostigma and at end of anal cells. Cross-vein r-m present or not; if present, short. Hind wing hyaline, unmarked.

Abdomen irregularly and usually indistinctly marked with fuscous above; rather distinct suture stripes on the sides in some individuals. Genital structures (Pl. XII, Fig. 7) similar to those of *novaescotiae*. Subgenital plate consists of two independent parts; the proximal part small, triangular, flap-like and notched apically. The egg-guide, arising independently, elongate, white, sparsely pilose apically and supported laterally at the base by a pair of independent chitinized strips. Ventral gonapophyses strong, very long, slender. Lateral gonapophyses white, curved, cup-shaped, half as long as wide, sparsely pilose. Dorsal gonapophyses very large, fleshy, trough-shaped, truncate, without apical knob or point. The rami appear to be a single stout piece but like *novaescotiae* actually h-shaped (looking at left gonapophyses). Sense tubercles on paraprocts white, much elevated, partially set in a black field. Suranal plate triangular but nearly truncate apically, dusky stripe medianly.

Male:

Length of body 3.8–4.5 mm.

Length of fore wings 5.0–5.5 mm.

Length of antennæ 7.0–8.0 mm.

Markings as in female; antennæ much stouter; hairs two or three times longer.

Abdomen slender, curved. Hypandrium asymmetrical (Pl. XV, Fig. 20). A ventral part, drawn out into a gently pointed beak-shaped piece. Above this is borne the quadrate distal part, featured by a pair of lateral plates arising almost perpendicularly—thus creating a trough-shaped structure—the interval between plates pilose. Structures on the right side are: on the perpendicular plate a short tooth dorsally; a long strongly chitinized prong, evenly rounded apically, proceeding dorsally and cephalically from its origin back of the trough-shaped piece and at the right distal margin of hypandrium; below base of this prong a small, roughly circular, chitinized tubercle. On the left side: the perpendicular plate is produced ventrally into a large posteriorly pointing prong; the rim further adorned dorsally by two teeth (or three if the pointed rim apex be counted); arising from a position comparable to the strong prong on the right a short, flat piece which is blunt-pointed; below and distinctly

separated from the trough-shaped piece occurs a large, elongate, highly chitinized protuberance produced distally into a disc with the flat surface uppermost. Parameres fused, symmetrical, somewhat 0-shaped basally. Paraprocts often uniformly white, similar in shape to *novaescotiae*; sense tubercles white, small, much-elevated; claw arising from lower margin of moderate size. Suranal plate broadly "notched" basally, apex evenly rounded.

New York: Ithaca, Aug. 30, 1926, 5 ♂, 4 nymphs, in slight depressions on moderately dry rock cliff, Sept. 6, 1926, 10 ♀ 6 ♂ on bark of dead beech snag associated with *Psocus leidy* Aaron, Aug. 13, 1895, 1 ♂ (N. Banks) M. C. Z.; Fairhaven, Sept. 7, 1924, 5 ♀ 1 ♂ on lower surface of loose stones; Cairo, Aug. 17, 1925, 1 ♀ under loose bark of apple; Sea Cliff, Aug. 6, ♂ on cedar, 2 ♀ 1 ♂ on pear (N. Banks) M. C. Z.

Massachusetts: Cambridge, 1 ♀ 1 ♂ M. C. Z. Ms notes of Harris: "Aug. 15, 1832 on side of house. On window in privy Sept. 1-Oct. 20, 1836." Specimens in collection bear date Sept. 6, 1837; another "numerous on fences." Types of *Psocus lucidus* in Boston Nat. Hist. Soc.

Rhode Island: Kingston, Sept. 1, 1907, 2 ♂ (Banks) M. C. Z.

Pennsylvania: Philadelphia, 1 ♂ (S. F. Aaron) M. C. Z.; Rockville, July 29, 3 ♀ 1 ♂ (Banks) M. C. Z.; Carrville, Aug. 2, 2 ♀ (Banks) M. C. Z.

Maryland: Plummers Island, July 24 1 ♀ (Banks) M. C. Z.

Virginia: Falls Church, Sept. 3 ♀ 3 ♂ (Banks) M. C. Z.

North Carolina: 1 ♂ (Morrison?) M. C. Z.

Illinois: Rock Island, 1863, 1 ♀ (B. D. Walsh) M. C. Z. Paratype sent to Hagen.

Texas: Austin, June, 1901, 1 ♀ M. C. Z. Holotype of *Psocus genualis* Banks.

Psocus purus Walsh resembles *leidy* and *novaescotiae* and with the latter is closely related. This species inhabits such places as stones, cliff walls, tree trunks and dwellings. *P. leidy* may share the same location. Of historic interest are the observations of Harris on this species; apparently he knew it well, having made collections and observations as early as 1832. The Ms. name *Psocus lucidus* cannot stand because his notes remained unpublished until 1869—Walsh named the species *purus* in 1862.

Psocus genualis Banks is, as an examination of the holotype revealed, a female of this species.

***Psocus quaesitus* new species**

Female:

Length of body 2.9 mm. ave. of 8 individuals.

Length of fore wings 3.8 mm. ave. of 8 individuals.

Length of antennæ 4.0 mm. ave. of 3 individuals.

Essentially identical with *slossonæ* in general appearance and markings, including those on wings. The markings are probably darker and the corresponding colored areas, larger.

Genital processes (Pl. XIII, Fig. 10) differ from *slossonæ* as follows: The subgenital plate consists of a pair of plates roughly equilateral triangular in shape; egg-guide short, broad, with rectangular chitinized central portion; bearing medianly a weakly chitinized thin strip which widens and involves the nearly truncate pilose apex; on each side of the egg-guide, at the base, weakly chitinized triangular plates; the lateral gonapophyses considerably shorter.

Male:

Length of body 2.6–2.8 mm.

Length of fore wings 3.7–3.9 mm.

Length of antennæ about 3.8 mm.

Markings as in female, often paler. Eyes large. Genital process (Pl. XV, Fig. 10) symmetrical except for a pair of slender arms arising from distal margin of hypandrium. Midway distally on hypandrium a large highly chitinized piece, consisting of an elongate distal portion and a pair of curved basal arms bent mesally to form the letter "O."

The asymmetrical arms already mentioned lie on each side and below this median piece; the left prong extends to the end of the median piece, while the right one arising somewhat lower, curves below the median piece, and extends beyond the left prong. A pair of chitinized strips bordering the lateral margins of hypandrium and a branch attached to the base of the asymmetrical prongs give rise to a pair of elongate less highly chitinized capsule-like pieces. Two chitinized bands lie one above the other at base of hypandrium. Laterally on 9th tergite a pair of blister-like cushions nearly touching the capsule-shaped pieces. Parameres fused, consisting of two flat arms joined to form a heart-shaped structure; proximally it is attached to the basal sclerite. The brown sense area is well towards the base of the paraprocts which distally are slender and terminate in the usual upward-pointing prong. Arising from the suranal plate perpendicularly a curious weakly chitinized plate which in profile consists of a pair of lateral lobes and medianly, of a sharp peak.

New York: Michigan Mills, Lewis Co., Sept. 1, 1926, 5 ♀ on dead hemlock and spruce limbs associated with *P. pollutus*; Gen-

eseo, Sept. 20, 1925, 1 ♀ on partially dead oak limb; Ithaca, Sept. 6, 1926, 1 ♂ on dead limb Holotype; Richburg, Sept. 16, 1925, 1 ♀; Parkers, Lewis Co., Sept. 2, 1926, 1 ♀; Artists Lake, Suffolk Co., Sept. 19, 1926, 1 ♀ on dead limb; Nigger Pond, Oswego Co., Sept. 3, 1926, 1 ♂; McLean, July 31, 1926, 1 ♀ on dry hemlock boughs in shade, associated with *P. pollutus*.

Psocus quietus Hagen

Psocus quietus Hagen. Syn. Neuropt. of N. A. p. 12. 1861.

Psocus semistriatus Walsh. Acad. Nat. Sci. Phila. **14**: 361.

1862. In part—1 ♀ 1 ♂ of Paratypes.

P(socu)s semistriatus Hagen and Walsh. Ent. Soc. Phila. Proc. **2**: 167, 182. 1863.

P(socu)s bifasciatus Walsh. Ent. Soc. Phila. Proc. **2**: 183.

1863. Not *P. confraternus* as surmised by Banks.

Blaste juvenilis Kolbe Stett. Ent. Zeit. **44**: 80. 1883.

Female:

Length of body 3.55 mm. ave. of 6 individuals.

Length of fore wings 4.4 mm. ave. of 6 individuals.

Length of antennæ 3.2 mm. ave. of 6 individuals.

Considerable variation in the intensity of markings. Head and thorax strongly marked with brown, the abdomen with dark grey or dark cinnamon brown.

Head: Dotted areas of vertex distinct or sometimes the lateral pigmented areas without distinct spots. A large brown spot covers the ocelli and extends over the front and slightly into the clypeus; clypeus strongly lineated with rich brown; on the anterior two-fifths a pair of distinct dark brown spots which vary considerably in size (in some specimens totally absent); genae white with a distinct brown spot medianly; posterior half of clypeolus and all of labrum brown. Eyes black; antennæ brown.

Thorax: Pleuræ irregularly marked with equal amounts of brown and white. Tergal lobes shining dark brown or black. Legs pale brown, the femora mottled with brown above. Wings: hyaline (Pl. XX, Fig. 16), largely covered with faint brown. Pterostigma: opaque, rather shallow, R_1 gently curved; a characteristic elongate dark greyish brown spot in inner "angle," only a slight amount of pigment below the cell. Distal third of

wing faintly brownish. An incomplete pale brown band from base of Rs to end of cell 1A together with another shorter one proximally; these are connected horizontally so that the total marking is H-shaped. Veins dark brown paling proximally; cross-vein r-m present or not. Hind wings unmarked.

Abdomen irregularly splotted or striped with dark grey or deep cinnamon brown; pigment largely confined to tergites. Terminal abdominal segments and genital processes (Pl. XII, Fig. 14) dark brown. The basal portion of the subgenital plate an inverted V-shaped piece giving rise at the apex to the broad, short, arrow-shaped egg-guide, the apex of which is blunt pointed and weakly chitinized. Ventral gonapophyses rather slender, extending a short distance beyond the egg-guide. The basal portion of the lateral gonapophyses swollen, strongly chitinized, pilose; the apical portion weakly chitinized, white. Dorsal gonapophyses with a long drawn out, chitinized apex. Suranal plate triangular, blunt pointed, bearing distally a row of five setæ—a pair of long lateral ones and three short median ones.

Male:

Length of body 3.0 mm. ave. of 5 individuals.

Length of fore wings 3.7 mm. ave. of 5 individuals.

Length of antennæ 3.5 mm. ave. of 5 individuals.

Marked as in female, possibly somewhat darker. The wings inclined to be uniformly faint fumose. Eyes black, larger than female. Antennæ rather stout, dark brown.

Genital processes (Pl. XIV, Fig. 3) symmetrical, dark brown. Hypandrium proper with the apex bearing a strongly chitinized semicircular piece, laterally on which arise a pair of short, sharp, dorsally pointing prongs, and arising between these a triangular piece with a thin, conspicuous, highly chitinized median rib. The parameres independent, consisting of a pair of long stout arms which arise from a small triangular plate which bridges hypandrium and the basal sclerite. Each paramere swollen distally, terminating in a sharp, lateral pointing hook. Sense tubercles on paraprocts large, brown, the apical portion twisted, bearing a short, plate-like, upward pointing prong. Suranal plate triangular, chitinized except a circular part at apex.

New York: "N. Y." M. C. Z. Holotype; Saratoga Springs, July 14, 1926, 20 ♀ 31 ♂ 1 nymph, on live branches of oak; Parkers, Lewis Co., Sept. 2, 1926, 6 ♀; Ithaca, July 11, 1926, 3 ♂ on dead limbs; Aug. 1, 1926, 1 ♀; Sept. 26, 1926, 1 ♀, Aug. 6, 1926, 2 ♀, Sept. 12, 1926, 2 ♀ 3 ♂ on dead poplar limbs; Ballston Lake, July 14, 1926, 1 ♀; Geneseo, Sept. 20, 1925, 2 ♀ on dead oak limbs; Whetstone Gulf, Sept. 2, 1926, 1 ♂; West Barre, Sept. 19, 1925, 1 ♀; Sodus, Aug. 16, 1926, 1 ♀.

Massachusetts: Cambridge, Sept. 1 ♀ (Banks). Holotype of *P. stigmatosalis*.

Maine: Beech Mt., Mt. Desert Island, Sept. 12, 1926, 1 ♀ 1 ♂ (C. P. Alexander); Southwest Harbor, Mt. Desert Island, Aug. 31, 1926, 1 ♀ (C. P. Alexander).

Virginia: Blacksburg, Oct. 4, 1926, 2 ♀ 1 ♂ 2 nymphs (C. & B.); Mt. Vernon, Oct. 28, 1926, 1 ♀ (C. & B.), deer park fence; London Bridge, Aug. 25, 1929, 3 ♀ 1 ♂.

Tennessee: Bristol, Oct. 5, 1926, 7 ♀ 1 ♂ (C. & B.) taken at light of Coca-cola stand; Laurel Creek, Sevier Co., Oct. 8, 1926, 1 ♂ (C. & B.).

Kentucky: Quicksand, June 25, 1925, 1 ♀.

North Carolina: Mt. Pisgah, Oct. 14, 1926, 1 ♀ (C. & B.).

Georgia: Tiger, Oct. 18, 1926, 1 ♀ (C. & B.).

Illinois: Rock Island, 1864, 1 ♀ (Walsh) M. C. Z. Paratype of *Psocus semistriatus*.

Psocus slossonae Banks

Psocus slossonae Banks. Jour. N. Y. Ent. Soc. **11**: 236. 1903.

Female:

Length of body 2.7–3.0 mm.

Length of fore wings 3.5–3.8 mm.

Length of antennæ about 3.8 mm.

Pale buff marked with brown and brown diffused with grey; decidedly pale above, most of the markings below.

Head: Pale buff above marked with indistinct brown dots on vertex; on front, a pair of lateral spots and a V-shaped one touching anterior ocellus; clypeus coarsely lineated—lineation fading out towards posterior margin; the anterior half or more of clypeus bears marks as in *desolatus* and *quaesitus* consisting of

three triangular brownish areas the vertices of which fuse medianly; posterior third of clypeolus and anterior three-fourths of labrum brown; genae brownish white medianly. Compound eyes large, dark, phosphorescent bluish-green. Third joint of maxillary palpus pale, remainder brown. Antennæ pale, median segment dark.

Thorax: Dorsal half of pleurae brown, remainder light tan; tergal lobes dull bluish white, irregularly marked with tan, especially laterally. Legs white at joints; coxae and femur of metathoracic legs brown; femora of other legs with broad ring of brown proximally and distally; ring or spot distally on tibia; tarsi brown. Wings (Pl. XX, Fig. 3) hyaline, beautifully marked with tan and dark brown, characterized by a series of six dark brown dots in the apical portion of wing. Pterostigma deep, but R_1 not angulate; basal third or half of cell whitish, margined with yellowish, unmarked; a small dark spot covers base, and a large irregular one on the apical half of cell. Wing further marked by an area between pterostigma and Cu, involved with brown dots; a brown band from base of pterostigma—widening as it proceeds—to cell 1A where it ends abruptly; two dark spots in basal portion of cell 2A; wing proximal of stripe slightly dotted, pale tan along costal margin; an incomplete tan band from apex of pterostigma to cell Cu_1 composed of four or five spots; a tan band borders outer margin of wing attaining the margin at end of veins where is found a dark brown spot, *inside the band lie the six characteristic dark brown spots*. Veins brown, fading proximally. M usually broadly joined to Rs. Hind wings hyaline, essentially unmarked.

Abdomen: Conspicuously colored pale tan. On sides a few small irregular brownish spots, chiefly at sutures; uniform brown diffused with grey below, sutures pale. Basal portion of subgenital plate (Pl. XIII, Fig. 7) consisting of a pair of widely separated elongate rather irregular plates. Egg-guide short, broad, somewhat arrow-shape but the apex broad; a row of hairs at apex; weakly chitinized medianly. Ventral gonapophyses short, slender, inconspicuous. Lateral gonapophyses consisting of a basal piece which is very short and broad, white and pilose; the distal portion non-pilose and drawn out laterally so that it ex-

tends slightly behind the dorsal gonapophyses. Dorsal gonapophyses of moderate size ending in a sharp, much drawn out chitinized point. Paraprocts and sense tubercle pale brown. Suranal plate gently pointed, supported laterally by short arms.

Male:

Length of body about 2.3 mm.

Length of fore wings about 3.7 mm.

Markings as in female, somewhat paler throughout. Eyes very large. Hypandrium (Pl. XV, Fig. 11) symmetrical, roughly quadrate; distally and laterally arise long, slender, mesally pointing arms; the distal portion weakly chitinized, broadly notched; mesally on the chitinized plates from which the arms arise an area sparsely pilose. Arising just below the junction of these pieces, a straight, slender, weakly chitinized, tassel-like piece, extending to distal margin of hypandrium. Basal portion of hypandrium consisting of two pieces as denoted by a pair of deep notches laterally—the upper piece triangular, sparsely pilose mesally; the lower part a narrow band. Parameres united, forming an angular O-shaped piece; fused distally, at which point arises a pair of short, highly chitinized, sharp pointed prongs. From the ninth tergite arises a pair of flat, blunt, hook-shaped pieces lying above lateral arms on hypandrium. Paraprocts lobe-like, the tooth arising apically, sharp and strong; sense tubercles flat, brown. From the base of the white, broadly triangular suranal plate arises perpendicularly a thin, concave, shell-like piece, which in profile consists of a pair of lateral lobes with the interval between straight.

New York: Ithaca, Sept. 12, 1925, 1 ♀ on bark of beech stump; Ceres, Sept. 16, 1925, 1 ♀ on trunk of ironwood; Richburg, Sept. 16, 1925, 1 ♂.

New Hampshire: Franconia, 2 ♀ M. C. Z. Holotype and Paratype.

Maine: Southwest Harbor, Mt. Desert Island, Aug. 31, 1926, 2 ♂ (C. P. Alexander); Beech Mt., Mt. Desert Island, Sept. 12, 1926, 1 ♀ (C. P. Alexander).

Tennessee: Bristol, Oct. 5, 1926, 1 ♂ taken at light of Coca-cola stand (C. & B.).

Psocus striatus

Psocus striatus Walker. Cat. Neuropt. Brit. Mus. p. 486. 1853.

Psocus frontalis Harris. Ent. Corresp. p. 330. 1869.

Female:

Length of body 3.9 mm. ave. of 3 individuals.

Length of fore wings 4.3 mm. ave. of 3 individuals.

Length of antennæ 3.8 mm. ave. of 2 individuals.

Head: Dotted areas on vertex conspicuous; front with a brown dot or two laterally and a faintly V-shaped mark medianly; clypeus pale yellowish, lineated with rather broad, brown lines which do not attain the anterior margin; posterior half of clypeolus and nearly all of labrum brown; genae unmarked. Antennæ brown. Eyes small, dull bluish black.

Thorax strongly marked with dark brown, a whitish line medianly above. Legs pale, tarsi brown. Wings (Pl. XX, Fig. 7) hyaline marked with rich chocolate brown. The pterostigma opaque, deep, R_1 rather sharply angulate; in about the distal third of the cell a dark brown spot extending below R_1 but preserving a characteristic small white area in the cell at the angle. An irregular spot in cell R_5 behind furecation of R_s ; an incomplete band extending from base of pterostigma to end of anal veins; basal half of cell 1A brown. This group of markings roughly forms the outline of a right-angled triangle, the base of the triangle being the anal wing margin, a line from end of anal vein to base of pterostigma from which point to the base of vein 2A completes the figure. Veins conspicuous, brown. M just touches or is not broadly joined to R_s . Hind wing hyaline, unmarked.

Terminal abdominal segments and genital processes (Pl. XII, Fig. 5). Subgenital plate consisting of a broad, rather narrow plate varying in the degree of chitinization as indicated in the figure. Pyramided on this medianly, a pair of lateral plates, then a single median piece and finally the extremely slender egg-guide. The ventral gonapophyses easily visible, rather strong, extending well beyond the apex of the egg-guide. Lateral gonapophyses large, cup-like, strongly chitinized proximally, pilose and bearing a row of hairs along the distal margin. Dorsal

gonapophyses blunt-pointed the rami extend almost to the apex, and infuscated area along mesal margin. Sense tubercles of paraprocts brown. An unchitinized area basally on suranal plate forms and equilateral triangle; midway the rather broad chitinized lateral strips bend below; the apex swollen, evenly rounded, unchitinized.

Male:

Length of body 3.4 mm. ave. of 2 individuals.

Length of fore wings 4.3 mm. ave. of 4 individuals.

Length of antennæ 4.5 mm. ave. of 2 individuals.

Marked as in female. Eyes small but still considerably larger than female. Genital processes asymmetrical occupying less of the abdomen than those of the female. Hypandrium jaw-like (Pl. XV, Fig. 14) with a long, rather broad, median chitinized ridge which turns slightly to the left distally and finally bends abruptly cephalad. On the left margin of hypandrium connecting the apex of the median ridge with the base and suspended midway between each by slender strips, an elongate irregular plate. The conspicuous parameres fused (Pl. XV, Fig. 17) and strongly chitinized, decidedly asymmetrical and generally triangular in shape. Viewing the structure *in situ*, on the right side arises a large thumb-like projection covered with tubercles, the mesal margin at the base beset with a row or two of stout teeth (not visible with structures *in situ*). On the left a similar thumb-like projection beset with tubercles, shorter, more crooked, not definitely dilated distally and basal portion much smaller. Arising from the strip between the two "thumbs" and close to the left projection, a non-tuberculate conical prong; it is not as long as the left projection. The basal portion consists of slender arms which fuse basally to form a roughly diamond-shaped plate. Sense tubercles flat; at point of attachment paraprocts bear a small highly elevated tubercle, and distally a rather flat, upward pointing prong. Suranal plate gently pointed, arrow-shaped.

New York: Ithaca, Sept. 6, 1926, 1 ♂, July, 1901, 2 ♂ at light in Fall Creek, Aug. 22, 1926, 1 ♀; Clarksburg, Sept. 18, 1925, 1 ♀.

District of Columbia: Washington, 1860, 1 ♂ (O. Sacken).

Missouri: Columbia, Sept. 1905, 1 ♀ (C. R. C.).

***Psocus subapterous* new species**

Male:

Length of body 3.2 mm. ave. of 5 individuals.

Length of fore wings 4.5 mm. ave. of 5 individuals.

Length of antennæ 3.0 mm. ave. of 5 individuals.

Closely related to *P. longipennis*, *quietus*, *subquietus* and *oregonus*.

Arms of epicranial suture fused to clypeus forming a small elliptical front. Clypeus faintly lined, adorned with four large spots as in *cockercelli*. Labrum brown; a distinct spot on genæ. Antennæ pale brown.

Wings hyaline or subhyaline, unmarked (Pl. XX, Fig. 14). The pterostigma long and shallow, non-angulate (similar to *longipennis*). Veins distinct, light brown. Considerable variation in the way that M is joined to Cu, ranging from a definite fusion for a short distance, to a condition such as obtains in *confraternus*.

Terminal abdominal segments and genitalia very similar to *subquietus* (Pl. XIV, Fig. 1) from which this species differs as follows: basal sclerite broader; the median prong of the distal processes of hypandrium long and pointed and with a more strongly chitinized median portion or core; the lateral hooks are directed only slightly mesally and their inner line forms an even curve; parameres show some differences as figured. The distal prong on the paraprocts triangular, appearing as if a notch had been made at apex of paraproct. Suranal plate triangular weakly chitinized apically. Female (subapterous):

Length of body 3.5 mm.

Length of antennæ 2.0 mm.

Similar in markings to male, much stouter. Eyes equal those of male in size but head of male only about one-third as large as female.

Wings reduced to two pairs of buds of which those on mesothorax bear three longitudinal ridges—the median ridge forked distally. Prothorax greatly reduced although tergal lobes of meso and metathorax much reduced over condition found in winged members of the genus.

Genital process similar to those figured for *quietus* and *oregonus*.

California: Sequoia National Park, Aug. 11, 1927, 1 ♀ 11 ♂ on Douglas fir (J. D. Hood). Holotype (♂) Paratypes. Allotype.

This is the only member of *Psocus* known to me in which the wings are reduced to a nearly apterous condition: some females of *P. longipennis* are brachypterous. I have found no previous record of the existence of short winged or subapterous individuals in the family Psocidae in this country or elsewhere in the world.

Psocus submarginatus Aaron

Psocus texanus var. *submarginatus*. Acad. Nat. Sci. Phila. Proc. **38**: 16. Pl. 1, Fig. 1, 1886.

Psocus submarginatus Enderlein. Stett. Ent. Zeit. **67**: 317. 1906.

Although it was only possible to make a cursory examination of the type series, *submarginatus* appears to be a distinct species and not, as indicated by Aaron, a variety of *texanus*. An excellent figure of the markings on the fore wing accompanies the original description and this and the size (length 3 mm.) should enable one to recognize the species.

Psocus subquietus new species

Female:

Length of body 3.4 mm. ave. of 5 individuals.

Length of fore wings 4.3 mm. ave. of 5 individuals.

Length of antennæ 3.15 mm. ave. of 5 individuals.

This species so closely resembles *quietus* that no sufficiently constant characters have been found to separate this species except in the male genitalia. The genitalia of the females appear to be identical. A character which is moderately constant is the markings on the vertex; in this species the epicranial suture is devoid of markings, or only faintly marked, while on each side lie large roughly square greyish purple spots (in nymphs and teneral individuals of both species these spots are found).

Male:

Length of body 3.0 mm. ave. of 5 individuals.

Length of fore wings 4.2 mm. ave. of 5 individuals.

Length of antennæ 3.85 mm. ave. of 5 individuals.

The genitalia (Pl. XIV, Fig. 15) differ from *quietus* as follows: Apically on hypandrium arises medianly a long, uniformly chitinized, drawn out, blunt-pointed prong (or with an indication of a slight fork); this prong is the termination of a distinct broad ridge which becomes distinctly swollen distally; on each side of this median prong a pair of mesally pointing claws, the strongly chitinized support of which lies along the lateral margins of the hypandrium, having no connection with the median piece as in *quietus*. The basal plate from which the parameres arise large, heart-shaped, the parameres similar to *quietus*, each arm is shorter.

New York: Ballston Lake, July 14, 1926, 7 ♀ 4 ♂ on dead limbs Holotype; Ithaca, July 11, 1926, 3 ♂ on dead limbs, Aug. 6, 1926, 2 ♀, Sept. 26, 1926, 2 ♀; Michigan Mills, Sept. 1, 1926, 2 ♀; Painted Post, Sept. 15, 1925, 2 ♀ 1 ♂ on dead hemlock limbs;

Nigger Pond, Oswego Co., Sept. 3, 1926, 2 ♀; Woodwardia Swamp, Tompkins Co., Aug. 10, 1924, 2 ♀ 10 nymphs under loose stones.

Tennessee: Bristol, Oct. 5, 1926, 4 ♀ (C. & B.) taken at light of Coca-cola stand.

***Psocus texanus* Aaron**

Psocus texanus Aaron. Acad. Nat. Sci. Phila. Proc. **38**: 16. 1886.

Female:

Length of fore wings 3.8 mm. ave. of 2 individuals.

Length of antennæ 3.8 mm.

Head: The usual dotted areas on vertex present; on the front a U-shaped mark and a pair of lateral spots; clypeus lined with moderate sized brown lines; a spot on genae. Eyes dull black, rather large.

Thorax: Tergal lobes shining dark brown. Legs pale, a brown spot inside, proximally on tibia; tarsi brown. Wings (Pl. XX, Fig. 22) hyaline marked with brown; the pterostigma opaque, rather deep, R_1 angulate, a brown spot distally and a smaller one below it touching R_1 ; a pale brown spot in cell R_5 just behind R_s furcation; distal third of wing faintly fumose. A distinct brown band from base of pterostigma to end of cell 1A; vein R and anal veins margined with brown, R_1 white. Vein M fused with R at a point. Hind wing hyaline, a pale brown spot at end of anal veins.

Terminal abdominal segments and genitalia (Pl. XII, Fig. 12). Subgenital plate U-shaped with the arms short and margins very irregular. The egg-guide short with pilose apex broad, rounded. The chitinized supports of the egg-guide V-shaped, the arms end before the apex. Ventral gonapophyses relatively stout, ending in a sharp point. Lateral gonapophyses large, broad, a sleeve-like structure with a pilose, strongly chitinized basal part and a nearly truncate distal portion. Dorsal gonapophyses trough-shaped with a much drawn out chitinized apex; rami strongly chitinized, stout; a large brownish area borders the mesal margin. Paraprocts short, with sense area brown,

large. Suranal plate with a median non-chitinized area at the base which is deep, crescent-shaped; apex blunt pointed.

Male:

Length of fore wings 3.7 mm.

Length of antennæ 3.7 mm.

Marked as female. Eyes large, dull black. Genitalia brown, asymmetrical. Hypandrium (Pl. XV, Fig. 21) jaw-like, bearing medianly a large, broad, elongate piece which terminates in a narrow cap. This median piece bears three ridges; when viewed from the rear, the right margin strongly chitinized and elevated, distally, twisting to the left; on the left side a pair of small narrow ridges arising near the base, running nearly parallel and twisting to the left. (In a lateral view an area proximo-ental of this ridge set with short spines. The other "ridge" terminates as an upward directed arm.) The parameres fused; elongate, trapezoidal in shape, the asymmetrical distal portion consisting of an irregular arm visible to the left of the apex of the hypandrium, and a blunt pointed prong and laterally a large plate or lobe-like piece; on the right a smaller lateral lobe. Paraprocts long, angular, the sense tubercles distal of half way, while terminally a moderate sized upward pointing prong. Suranal plate longer than wide, a non-chitinized basal portion equilateral triangular in shape.

Texas: Described from 1 ♂ and 2 ♀. Paratypes kindly supplied by E. T. Cresson, Jr., from Aaron's type series in the Philadelphia Academy of Natural Sciences.

***Psocus trifasciatus* Provancher**

Psocus trifasciatus Provancher. Natur. Canad. 8: 186. June, 1876.

Psocus speciosus Aaron. Amer. Ent. Soc. Trans. 11: 40. Pl. 9, Fig. 7. 1883.

Cerastis nigrofasciatus (Hagen) Kolbe Stett. Ent. Zeit. 44: 70. 1883.

Psocus tolteca Banks. N. Y. Ent. Soc. Jour. 11: 237. 1903.

Cerastipsocus nigrofasciatus Enderlein. Stett. Ent. Zeit. 67: 318. 1906.

Cerastipsocus trifasciatus Banks. Cat. Neuropt. Ins. U. S. p. 10. 1907.

Female:

Length of fore wings 4.7–5.1 mm.

Length of body 4–4.3 mm.

Length of antennæ 7–8 mm.

Head yellowish white, thorax and abdomen brown, wings conspicuously marked with three bands of brown.

Head whitish above, faintly marked with orange in the position of the usual dotted areas. Ocelli deep brown or black. A wide light brown V on front. Clypeus lineated with light brown lines of moderate width. Proximal half of labrum brown. Genae concolorous with vertex, unmarked or only faintly so. Maxillary palpus brown deepening distally. Eyes dull black. Third segment of antennæ pale, deepening to dark brown distally.

Thorax: Tergal lobes dark, shining brown margined with whitish: Pleuræ and coxæ brown. Femora pale, tibiae and tarsi brown. Wings (Pl. XX, Fig. 21) hyaline, largely marked with brown. Pterostigma short, very deep and subangulate. This cell is opaque, white in proximal two-thirds and brown distally. Distal half of wing with three bands diverging from cells Cu_1 and M_3 : the proximal margin of one runs from the base of Rs across to cut cell Cu_1 in half; another extends along wing margin from Cu_1 to R_{4+5} or slightly beyond (may not attain margin except at veins); the other lies between these two, lining up with distal spot in pterostigma. There is a hyaline band running across the wing through the middle of cell M; proximal to this the wing is largely brown except for a large hyaline spot on vein M Cu and several smaller ones on cell 1A. Generally veins white in proximal half of wing, brown in distal half. Hind wings hyaline, unmarked.

Abdomen a purplish brown, paling below and pale at sutures. Genitalia and terminal segments (Pl. XII, Fig. 11) similar to *venosus*. The subgenital plate a rather narrow bar, widening and slightly notched laterally. The egg-guide is urn-shaped with the apex swollen, weakly chitinized, pilose and with a slight depression. A slender weakly chitinized core lies in distal half

of egg-guide. Ventral gonapophyses of usual shape, long. Lateral gonapophyses large, weakly chitinized; basal third more strongly chitinized, pilose; distal two-thirds non-pilose, fitting sleeve-like to dorsal gonapophyses. Dorsal gonapophyses shallow, trough-shaped, weakly chitinized, apex pointed; infuscated area inside distally and mesally. Sense tubercles of paraprocts concolorous with brown lateral surface of paraprocts. An infuscated area covered with tiny spines at base of paraprocts mesally on ventral surface. Suranal plate triangular, weakly chitinized and with five or six stout spines distally.

North Carolina: "N. C." 5 ♀ (? sex) (Morrison) M. C. Z.; "N. C." 2 ♀ (? sex) Morrison. Types of *Psocus speciosus* Aaron P. A. N. S.; Goldsboro, Sept. 1903 (F. Sherman) 1 ♀ M. C. Z.

Kentucky: "Ky." May, 1 ♀ (Sanborn), June, 1 ♂ labelled "*Ps. nigrofasciatus* Hagen" apparently in Hagen's handwriting.

Virginia: Falls Church, 2 ♀ (? sex) (Banks) M. C. Z.

Georgia: Tallulah Falls, 18 Oct. 1926, 1 ♀ (C. R. C.).

Arizona: Ruby, Aug. 30, 1927, 1 ♀ on dead yucca or agave (J. D. Hood).

***Psocus variabilis* Aaron**

Psocus semistriatus Walsh. Acad. Nat. Sci. Phila. Proc. **14**: 361. 1862. Partim.

Psocus variabilis Aaron. Am. Ent. Soc. Trans. **11**: 38. Pl. 9, Fig. 5. 1883.

Psocus medialis Banks. Jour. N. Y. Ent. Soc. **15**: 165. 1907. Female:

Length of body 3.0 mm.

Length of fore wings 3.6 mm.

Yellowish white, sparsely marked with brown. Head with a brown area involving ocelli and epicranial suture; the other areas on vertex dotted, faint; clypeus faintly lineate, a distinct pair of brown spots on posterior two-fifths; genae unmarked; labrum brown. Eyes of moderate size, dull black.

Thorax: Tergal lobes shining brownish black. Legs pale. Wings (Pl. XX, Fig. 8) uniformly hyaline throughout. Pterostigma of moderate depth, R₁ gently rounded. Veins yellow or light brown. M joined with Rs for a short distance.

Abdomen: Spotted with fuscous above, and three or four stripes on the sides. Terminal segments and genital processes (Pl. XII, Fig. 10). Base of subgenital plate wide, short, consisting of a pair of plates which are bound on all sides by highly chitinized border except mesally. Egg-guide somewhat arrow-shaped, blunt pointed, the distal three-fifths weakly chitinized and the lateral margins parallel. Ventral gonapophyses normal. Lateral gonapophyses sleeve-like, rather weakly chitinized and slightly pilose on the swollen proximal half. Dorsal gonapophyses, with a drawn out sharp apex; a small brownish area along disto-mesal margin. Suranal plate blunt-pointed, triangular.

Male:

Length of fore wings 3.5 mm.

Marked as female. Eyes large. Genital processes (Pl. XIV, Fig. 19) asymmetrical, strongly chitinized, cap-like. Basal sclerite very large, fused broadly to the roughly triangular hypandrium. Distally on hypandrium the structures disposed as follows, proceeding from the outside in: outermost, arising on the right and twisting to the left a large hollow swollen piece which ends in a point; arising below but extending beyond (from some angles appearing as a continuation of the first structure) a circular piece; lying below the cap formed by these two structures, on the left, a strong, inward directed, sharp prong supported by chitination from the left margin of hypandrium; then mesally a curious straight rod which is worked distally. On the right, supported by chitination from the margin of hypandrium a small twisted, elongate, flat piece, the outer surface of which is thickly studded with stout tubercles. Parameres independent, consisting of a pair of rather straight rods which distally are swollen and forked. A small prong distally on the paraprocts. Suranal plate with a small triangular perpendicular part.

Pennsylvania: Philadelphia. (S. F. Aaron).

Described from two paratypes, one kindly supplied by the Philadelphia Academy of Natural Sciences and the other by the Museum of Comparative Zoology.

Florida: Appalachicola 2 ♂ (M. C. Z.). Holotype and Paratype of *P. medialis* Banks.

***Psocus venosus* Burmeister**

Psocus venosus Burmeister. Hanb. Ent. 2: 778. 1839.

Psocus microphthalmus Rambur. Hist. Nat. Neuropt. p. 321. 1842.

Psocus magnus Walker. Cat. Neuropt. Brit. Mus. p. 484. 1852.

Psocus aceris (Fitch in litt.) Hagen Verh. zool.-bot. Ges. Wein. 16: 211. 1866.

Psocus gregarious Harris. Ent. Corresp. p. 329. 1869.

Cerastis venosa Kolbe. Stett. Ent. Zeit. 44: 69. 1883.

Cerastipsocus venosus Kolbe. Berlin, Ent. Zeit. 28: 38. 1884.

Psocus gossypii Ashmead. Insect Life 7: 29. 1894.

Female.

Length of fore wings 6.4 mm. ave. of 10 individuals.

Length of body 4.4 mm. ave. of 10 individuals.

Length of antennæ 8-10 mm. measurement of 10 individuals.

Wings uniformly brownish black; the abdomen dark brown ringed with white or yellow and the head and thorax dull orange. (In poorly preserved specimens and those which have been in alcohol several years the wings become a drab brown and body colors dull.) Head dull orange unmarked, except for indistinct brownish areas on vertex and faint lineation on clypeus. Maxillary palpus brown, the segments small. Eyes a phosphorescent blue-green. Antennæ dark brown except segments 1 and 2, which are pale.

Thorax nearly concolorous with head; tergal lobes brown medianly and the median lobe dark brown anteriorly while the posterior margin of the lateral lobes is abruptly cream colored in fresh specimens; pleurae dusky. Femora pale; tibia dull orange, dark brown distally; tarsi dark brown. Fore wings (Pl. XX, Fig. 23) uniformly brownish black throughout changing to a golden brown with long preservation in alcohol. Pterostigma opaque, white, in some individuals variously covered in extent and intensity with grey; the cell is deep, angulate, isosceles triangular in shape. Veins in basal half of wing white, R dusky, those on apical half dark brown. Hind wing uniformly fumose.

Abdomen typically dark brown suffused with grey and with narrow stripes of cream or yellow at the sutures of the tergum; also coarsely dotted and streaked with whitish at the spiracles and elsewhere. Terminal segments and genital processes (Pl. XII, Fig. 4) from below pale, the structures are weak and "made out" with difficulty. The subgenital plate consists of a narrow basal stripe which gives rise medianly to the urn-shaped egg-guide with a superficial apical pocket. Ventral gonapophyses short, stiletto-like, extending below and shortly beyond the egg-guide. The proximal and lateral portion of the lateral gonapophyses strongly chitinized and pilose; the concave distal and inner portion non-chitinized, non-pilose. Dorsal gonapophyses weak, inconspicuous, apex abruptly pointed; chitinized support strong, produced into an inverted Y distally. Lateral and dorso-distal portion of paraprocts strongly chitinized; sense tubercles brown, large, much elevated. Suranal plate triangular, apex swollen, pilose, weakly chitinized.

Male:

Length of body 3.3 mm. ave. of 10 individuals.

Length of fore wings 4.7 mm. ave. of 10 individuals.

Length of antennæ 9 mm. from one specimen.

Closely resembles female in general appearance: wings possibly slightly darker, the pterostigma usually clouded partly or entirely with grey and brown; eyes of moderate size, larger; antennæ proportionately stouter, more densely pilose.

Genital structures small, symmetrical; hypandrium (Pl. XIII, Fig. 9), a narrow jaw-like piece which bears distally a membranous or weakly chitinized pouch-like portion supported medianly by a short, flat ridge and laterally by a pair of shorter finely drawn out twisted strips. The median ridge widens and is slightly notched or truncate distally. The parameres united, forming an elliptical structure and consisting of a pair of thin rods fused proximally and closely appressed distally; the distal portion normally extending slightly beyond the end of the median ridge on hypandrium. Sense tubercles on paraprocts brown, large: the distal portion large, plate-like, produced distally into a blunt point below which arises a sharp upward di-

rected claw. Suranal plate triangular with the apex and a small triangle at the base weakly chitinized.

New York: Ithaca, Aug. 9, 1890, many ♀ and ♂ (A. P. Morse), Aug. 17, 1897, 3 ♀, Aug. 23, 1897, 5 ♂ 4 ♂, July 25, 1896, many ♀ and ♂, Aug. 4, 1898, 2 ♀, Aug. 8, 1892, 2 ♀ 6 ♂, Aug. 9, 1890, ♀ and ♂: Westport, Aug. 11, 1906, 3 ♀, N. Y. S. M.: Middleburg, Aug. 10, 1881, 1 ♀, N. Y. S. M.: Coy Glen, Tompkins Co., July 30, 1921, 2 ♀; Alpine, Aug. 20, 1897, 4 ♀.

Rhode Island: 6 ♀ 2 ♂.

Maryland: Somerset, July 24, 1926, 5 nymphs (E. N. Cory).

Illinois: Urbana, Aug. 7, 1885, 1 ♀, I. N. H. S.; Normal, 4 ♀, I. N. H. S.

Georgia: Spring Creek, Seminole Co., 3 ♀ 4 ♂ (C. R. C.); Billy's Island, Okefinokee Swamp, July, 1912, 3 ♀ 2 ♂; St. Simons Island, April 22-May 12, 1911, 3 ♀ 3 ♂ (J. C. Bradley).

Florida: Gainesville, 104 ♀ 145 ♂ (T. H. Hubbell); Orlando, Aug. 2, 1926, 8 ♀ 2 ♀ 37 nymphs (O. C. McBride), June, 1927, 3 ♀ 2 ♂ (O. C. McBride); St. Cloud, Jan. 20, 1927, 44 ♀ 12 ♂ (M. D. Leonard) on trunk of orange tree feeding on lichens or the fungus growing on old scale insects. All the individuals in a colony; Wewahitchka, Dead Lake, April 6, 1927, 14 nymphs (C. R. C.); Key West, 2 ♂ (Morrison) supplied by M. C. Z.

Louisiana: Baton Rouge, April 21, 1922, 13 ♀ 3 ♂ on bark of wild cherry; May 3, 1927, 12 ♀ 6 ♂ 12 nymphs on bark of oak. (All by O. W. Rosewall.)

Subfamily Pseudopsocinae

Pseudopsocus new genus

Genotype: *Psocus amabilis* Walsh 1863.

Except for the wing venation, which is essentially that of *Psocus*, this genus resembles members of the family Caeciliidae, especially *Lachesilla*. Subcosta absent; R and R₁ parallel costa until the middle of pterostigma, where R₁ curves strongly into the wing and as suddenly turns to costa, causing the pterostigma to be deep and truncate distally. *Pseudopsocus* differs from *Psocus* as follows: veins in basal third of wings adorned with hairs; tibiae of metathoracic legs unarmed with ctenida; male genitalia differing in many particulars as indicated in the figure and description of *Pseudop. amabilis*; a readily discernible difference is the absence of a distal claw on the paraprocts. In the female the subgenital plate is simple, without an egg-guide, and the gonapophyses have been united into a single pair.

***Pseudopsocus amabilis* (Walsh)**

Psocus amabilis Walsh. Acad. Nat. Sci. Phila. Proc. **14**: 362, 1862.

Psocus minusculus Banks. Am. Ent. Soc. Trans. **32**: 3, 1905.

Female:

Length of body 2.5 mm. ave. of 7 individuals.

Length of fore wings 2.7 mm. ave. of 7 individuals.

Length of antennæ 1.9 mm. ave. of 7 individuals.

Dull orange throughout except that the abdomen, exclusive of the genital processes, is paler. Head unmarked, covered above with long dark hairs which are shorter on clypeus, genae non-pilose. Maxillary palpus concolorous with head. Compound eyes small, dull black. Antennæ moderately stout, first two segments, while stout, not much thicker than the others; proximal half of each segment, exclusive of 1 and 2, pale, apical portion brownish; distal segments become uniformly light brown.

Thorax: Slightly deeper colored than head in some specimens. Dorsum covered with hairs, similar to those on head, darker. Legs slightly paler than thorax. Fore wings (Pl. XX, Fig. 1) slightly clouded with brownish. Pterostigma only slightly opaque. Brownish spot at base of pterostigma and also deeper colored at end of anal veins. Veins conspicuous, light brown. R and R₁ parallel with costa until about the middle of pterostigma where R₁ curves posteriorly rather deeply and then curves sharply back to costa so that the distal margin of pterostigma is truncate. M broadly joined to Rs. Hind wings subhyaline.

Abdomen generally lighter than remainder of body, marked with pale, irregular stripes of greyish orange, paling out below. Terminal segments and genital processes (Pl. XVIII, Fig. 10) concolorous with head and thorax. Subgenital plate an inverted V in shape, with a rather blunt, rounded apex. A fine white line medianly at apex separates each element of subgenital plate. Gonapophyses (Pl. XVIII, Fig. 9) reduced, consisting of a single concave piece, and distally drawn out into a sharp, upward pointing prong. Paraprocts with a strongly chitinated portion involving the apex and lateral surface; sense tubercles small,

brown; proximo-mesally a large area covered with short hairs while at the apex several conspicuous bristles. Suranal plate cap-like, short, triangular from above.

Male:

Length of body 1.9 mm. ave. of 7 individuals.

Length of fore wings 2.1 mm. ave. of 7 individuals.

Length of antennæ 1. mm. ave. of 7 individuals.

Colored as female, usually head and thorax darker and abdomen paler. Eyes small, only slightly larger than female. Genital processes (Pl. XVIII, Fig. 7) symmetrical, occupying only a small portion of abdomen; concolorous with head and thorax. The large O-shaped parameres arise from a small crescent-shaped plate—the basal plate, whence the extremely thin highly chitinized arms advance to hypandrium. Just below the base of hypandrium, hinged to, and when viewed from below appearing as a continuation of the lower clasper arms, advance a pair of thin strips which soon fuse medianly and give rise to a strong, inward curved hook. Below the hook lies what is probably a true penis which resembles the letter Y; this is part of a pocket-like formation of two plates, one margined by the strips bearing the clasper hook and the other by the continuation of the lower clasper strips. Hypandrium short, shield-like, the distal margin bearing a pair of inconspicuous short teeth. Sense areas on paraprocts, proximal, small; the distal portion broad, weakly chitinized. Suranal plate a thin crescent-shaped piece.

New York: Ithaca, Sept. 12, 1925, 7 ♀ in dry oak and poplar leaves; Sept. 6, 1926, 9 ♀, July 11, 1926, 2 ♀; Sea Cliff, L. I., Sept. 6, 1925, 6 ♀ 4 ♂ in dry oak leaves; Olcott, Sept. 19, 1925, 18 ♀ 3 ♂; Rock City, Sept. 16, 1925, 7 ♀ 3 ♂; Geneseo, Sept. 20, 1925, 1 ♀ 1 ♂; Barcelona, Sept. 18, 1925, 7 ♀; Stow, Sept. 17, 1925, 28 ♀ 6 ♂; Richburg, Sept. 16, 1925, 16 ♀ 4 ♂; Ceres, Sept. 16, 1925, 3 ♀; Clarksburg, Sept. 18, 1925, 2 ♀; Painted Post, Sept. 15, 1925, 9 ♀; Silver Creek, Sept. 18, 1925, 18 ♀ 5 ♂ in dead oak leaves; Elmira, Oct. 1, 1925, 18 ♀ 5 ♂ in oak leaves; Penn Yan, Aug. 29, 1926, 12 ♀ 5 ♂; Ballston Lake, July 14, 1926, 1 ♀; Hudson, July 15, 1926, 1 ♀; Nigger Pond, Oswego Co., Sept. 3, 1926, 1 ♀.

Illinois: Rock Island, 1864, 1 ♀ (B. D. Walsh) M. C. Z. Paratype.

Virginia: Blacksburg, Oct. 4, 1926, 1 ♀ 1 ♂ (C. & B.); Falls Church, Oct. 10, several specimens. Types of *P. minusculus* Banks. M. C. Z.

Tennessee: Mill Creek, below falls on Mt. Leconte, Oct. 10, 1926, 1 ♂ (C. & B.).

(To be continued)

BIOLOGICAL NOTES ON SOME WESTERN CICADAS

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Special attention was given to the collecting and study of cicadas during the biological field trip from Kansas to California and return in the summer of 1929. The ear of each member of the party was trained to listen for their song and, when it was heard, every effort was made to secure specimens and notes on the songs, nesting habits, general habitat, etc. Cicadas were collected in all sorts of habitats: in the desert at a temperature of 120 degrees, below sea-level in Salton Sea valley, where the dust was six inches deep in the fields, on precipitous cliffs, on mountain sides where chapparal was almost impenetrable, among cacti, in huge trees, and in holes in the ground.

In all, 831 specimens were taken belonging to thirty-one species and varieties. While only one variety was new to science, this series added twelve species and varieties to the Snow collection and completed the series of four specimens in seven other cases. The authors are deeply indebted to Mr. Wm. T. Davis, Staten Island, N. Y., for making all the determinations.

The following notes are arranged in the order in which the species were taken and hence present a chronological arrangement but no sequence at all as to relationship of species.

Okanagana bella var. *rubrocaudata* Davis

The first cicadas heard were at Raton Pass, N. M., June 26. *O. bella* var. *rubrocaudata* Davis was singing in pine trees in the forenoon. Five males and one female were taken. The specimens were not numerous and were located with difficulty.

Platypedia putnami Uhler

A mating pair of *P. putnami* Uhl. was taken with the hands from a scrub oak shrub in this same locality. No other specimens were heard or seen.

Cacama valvata Uhler

The party next found a large brood of *C. valvata* Uhl., June 28, on the steeply sloping side of the mesa about thirty miles west of Santa Fe, N. M. Stopping near the foot of the hairpin trail leading off of the mesa, everyone collected for an hour in a habitat of cane cactus sparsely set among large boulders. From one to many cicadas could be located on each cactus and it was soon discovered that they could be taken with the fingers if one moved slowly and steadily upon them. They usually were found sitting on the thorns. In only one case was one observed in such position that it was thought to be feeding on the green stalk. The males, which predominated in numbers, sang with a high pitched, even, metallic zing. The females were ovipositing almost entirely in the very dry dead skeletonized stems of the cactus. Very rarely was green material used. A great many nests were collected and several large series were sent to the laboratory at Lawrence for further observation. There were usually four or five eggs in a nest in irregular arrangement. Quite often the stems were so filled with nests that it was difficult to determine where one nest ended and another began. The entire outer surfaces of the stems were roughened by the torn tissue at the nest openings. There were many emergence holes in the dry ground between the boulders and numerous exuvia were found clinging to rocks or cactus thorns. Forty-nine males and thirteen females were taken. While the vegetation here was exclusively cane cacti, *Cacama valvata* Uhl. was taken six miles farther southwest in a habitat of sage brush, yucca, and cedar where there was no cactus.

Again, near Ashfork, in the north edge of Yavapai Co., Ariz., seven males and five females of this same species were taken in a habitat of small cedars on the first of July. The striking difference in the brood here and that studied in New Mexico was that these were exceedingly wild. The specimens were easily spotted perhaps twenty feet away as they perched on the edge of small cedar twigs, but the greatest caution was necessary to take them with nets. The collectors soon learned to circle the tree and approach as near as possible to the cicada before com-

ing in sight. From this ambush a quick stroke of the net was sometimes effective. When collecting began at 4 P. M. a number of males were singing. The song was from six to nine seconds duration with the rest between songs varying from eight to fifteen seconds. The rate of vibration usually became slower toward the end of the song. Within half an hour after collecting began, all the songs had ceased and they did not begin again while the party remained.

One female was observed and photographed ovipositing in a cedar twig three-sixteenths of an inch in diameter six inches from the tip. She flew before a picture at close range could be taken. She had made eight nests in a straight line sitting with her head toward the tip of the twig. The nests each contained five eggs, inserted two, two, one from the bottom up, slightly mismatched. The nest opening was left jagged. The eggs shriveled when the host withered.

A cicada was heard on Yarnell Hill, Ariz., which was thought to be this species but no specimens were taken.

The nests of eggs in cane cactus were placed over live cages in Lawrence, Kansas. When they were examined September 12, the eggs were found to be pink and the dark eyespots and tarsal claws were plainly visible. On September 13, a stem was immersed in water and placed in the morning sunlight. In half an hour the nymphs were emerging rapidly. In an hour the hatch for the day was completed. Later the stems were wet in the afternoon with no result. September 17, they were left in a cold rain during the early morning. About eight A. M., with the temperature fifty-two degrees, the nymphs began emerging. September 20, forty-six nymphs emerged following immersion of the stem. Subsequent wettings brought out two or three nymphs. The egg stage, under conditions of Kansas climate, appears to be nearly three months.

The observations on these relatively few nests of eggs indicated that the eggs hatched only in the presence of moisture and reduced temperature. This seems not an illogical phenomenon for surely the fragile nymphs would be helpless in the normal excessive heat and drouth of the New Mexico desert and probably their only chance for life is to wait until one of the rare

desert storms wets the stem and the ground and reduces the temperature.

The notes on the eggs of the two different broods offer interesting problems. Only one instance has been found in the study of Kansas cicadas where the eggs of a species, which usually will withstand the wilting of the host plant, wilt in a special host. This instance was where a female *Tibicen dorsata*, caged over a small black walnut tree, oviposited in the stems of the deciduous leaves. When the leaves withered, the eggs did, also. In this case the conditions were considered to be so abnormal that no special importance was attached to the phenomena. In the case of *Cacama valvata*, however, both ovipositions were made under natural conditions. In both instances the female had a choice of live or dead material. The fact that one brood used live and the other dead is not unique. Many Kansas cicadas use live or dead tissue. But, if the eggs placed in the green cedar were dependent on the continued health of the host for their proper development, it is the first case observed where one species of cicada lays eggs in dead tissue so protected that they will mature of themselves and also in green tissue so unprotected that they will wilt when the host does. Of course, it is possible that the one female observed ovipositing in green cedar was not typical of the brood.

Diceroprocta eugraphica Davis

In a waste-land of sagebrush and cedar thirty miles east of Albuquerque, N. M., thirty-three males and twelve females of *D. eugraphica* Davis were taken June 27. Some were caught with the hands but they were more easily taken with nets. The song is a series of clicks, then a high-pitched whirr. When disturbed they flew a considerable distance, usually out of sight.

Diceroprocta cinctifera Uhler

At two P. M., on June 27, a few specimens of *D. cinctifera* Uhl. were heard singing in cottonwoods along an irrigation ditch near Isleta, New Mexico. One male was shot. The song is loud and can be heard for a considerable distance.

Okanagana magnifica Davis

On a hillside covered with pine, cedar and sage brush about fifteen miles west of Gallup, New Mexico, a large brood of *O. magnifica* Davis were singing lustily from nine to eleven A. M. on June 28. As many as thirty-six emergence holes were counted in a circle three feet in diameter and the exuvia were numerous in all the trees.

The song is not loud for so large a cicada and is of short duration, beginning and ending in a series of clicks. The song resembled somewhat that of one of the tree crickets. Many specimens were located by throwing a club into a tree and watching where the cicadas alighted when they flew. Some specimens were shot, some taken with nets, and a few stunned by hitting the limb near where they were sitting with stones and sticks with sufficient force to stun them till they fell to the ground. Mating was observed once but no eggs were found. Twenty males and twenty-three females were taken:

Tibicen duryi Davis

Along with the songs of *O. magnifica* Davis, near Gallup, New Mexico, the much longer and louder song of *T. duryi* Davis, was occasionally heard. In the two hours spent here, only seven males and one female were taken although special attention was given to them. Most of these specimens were shot because they were found too high in the trees to be reached with a net. Two specimens were taken by climbing the trees and catching them with the fingers.

This species was observed again ten miles north of Williams, Ariz., in cedar trees, July 1. Four males were taken. This brood was difficult to frighten out of trees and specimens could be taken with the fingers when they were accessible.

Again, in Zion National Park, Utah, August 12, this loud singer was found in pine trees. Here one male and one female were taken with nets and one was taken by hand, although it was necessary to climb the tree to reach them in two of the three cases.

In all three habitats this species was heard singing between eight A. M. and one P. M. In each case the song was noted to

be very loud and of long duration and resembled somewhat in rhythm the song of *Tibicen dealbata* Davis or *T. marginalis* (Walker). In none of the three habitats was there a large brood.

Tibicen bifida Davis

T. bifida Davis occurred in great numbers, June 28, in the sage brush waste from Navajo, Arizona, almost to the Painted Desert. The vegetation was growing in deep, shifting sand. They were singing lustily at twelve thirty but, though easily located, they were wary enough to be rather difficult to take. Because this species occurs and has been studied in Kansas, only eleven males and nine females were collected.

Diceroprocta apache Davis

D. apache Davis was common over large areas and occurred in a great variety of habitats, all of which were of low altitude. A number of males were heard singing in willow at eight P. M., June 30, at the bottom of the Grand Canyon. Only one was taken. A large brood occurred near Wickenburg, Ariz., July 2, in a habitat almost exclusively Palo Verde trees. Phoenix was noisy with their songs at half past six in the evening and again at ten in the morning. Near Yuma the party was welcomed when it arrived at half past seven P. M. (Rocky Mountain time), for all along the Colorado River and the irrigated section west of the river there were myriads of these noisy friends. Even in the Salton Sea valley, *D. apache* was busy singing at eight P. M., July 28, and again at seven the next morning. Exuvia clung to the wire netting around the government laboratory in Coachella. Nests of eggs were found in sunflower stalks nearby. Hundreds of adults were living in a citrus orchard a few miles north of town. As many as twenty were found in one tree. In a little group of mesquite trees a mile farther north, numbers were picked off the limbs with the fingers. Here large cicada-killers were at work but eluded the collectors.

The nests in sunflower stems were placed in a straight line from two to sixteen in a series so close together that one extends to the next. Nine or ten large eggs were placed in mismatched pairs down the stem from the nest opening. Seventy-four males and twenty-four females were taken.

Okanagana striatipes var. *beameri* Davis

About eight miles north of Williams, Arizona, numbers of a new variety of *O. striatipes* which Mr. Wm. T. Davis has described as var. *beameri* in the March, 1930, number of the JOURNAL, NEW YORK ENTOMOLOGICAL SOCIETY, were singing at eleven A. M., July 1. The habitat here was a flat, sparsely covered with very short sage brush. Again, on the same day, this variety was collected east of Ashfork, Arizona, in a similar habitat. Two exuvia were found clinging to sage brush twigs. One female was observed ovipositing in the live stem of a composite weed. The female was sitting with her head down the stem. She had made two series of nests, two nests in each series. The nests each contained six slender white eggs placed up the stem from the opening in two even rows. The eggs shriveled when the host wilted.

The song of the male was of medium pitch and of average duration.

Pacarina puella Davis

While collecting *Cacama valvata* Uhl., near Ashfork, Ariz., the party heard a male *Pacarina puella* Davis singing in a cedar near the road. It was located by its song and taken with a net.

Diceroprocta swalei Distant

Eleven males of *D. swalei* Dist. were taken about halfway down Yarnnell Hill, Ariz., July 2. They occurred on catclaw, cactus and other desert plants on this almost barren, boulder-covered hillside. The song was loud and varied from thirteen to twenty-three seconds in duration with a rest of ten seconds or more between songs. They frequently ceased singing when approached but could sometimes be taken with the hands when they were located.

Cacama dissimilis Distant

In the northern edge of Maricopa Co., near Hot Springs, Ariz., twelve males and ten females of *C. dissimilis* Dist., were taken July 1. They resembled *C. valvata* Uhl. very closely in the field. The song was loud and steady. The habitats here were almost exclusively Palo Verde trees and several females were observed

ovipositing in the terminal twigs which were from one-eighth to one-fourth inch in diameter. The nests occurred in series of from three to twenty and each contained six eggs placed in mismatched pairs. The eggs in several nests examined had all hatched. These nests appeared to have been made this year, yet no eggs were observed which were nearing maturation. It is possible the empty nests were made the year previous. The eggs taken shriveled.

Okanagodes gracilis Davis

O. gracilis Davis came to be a familiar part of the desert as the party journeyed south throughout Arizona to Phoenix and thence west to Yuma. The intermittent Z'---- Z'---- Z'---- of this little white cicada was loud enough to be heard by the normal ear in a moving auto. One member of the party, with slightly defective hearing, could not detect their song even when quite close to them. The cicada sings for minutes at a time when undisturbed but may cease its song or change to a more broken one when it is approached. They are not easily frightened from their perch and are taken with a net or the hands without difficulty. It occurs on any kind of desert vegetation and appears to thrive in a habitat which looks to be almost entirely dry and dead. When one has attempted to rear cicadas in captivity and failed under circumstances which seem to be favorable, one cannot help wondering how the tiny, frail nymphs ever succeed in reaching the safety of a cell and food through the mass of dry, shifting sand which surrounds these desert plants, or how an adult, so dependent upon plant juices for food, can find enough sap in a desiccated sage bush to sustain life. But here they were in abundance from Hot Springs to Phoenix and from Phoenix to Yuma singing happily in the sun, when the temperature was 122 degrees in the shade. The excellent protective resemblance may account for the fact that only two females were taken with sixty-three males. One other was observed on a stem about three inches from a male but flew before she could be taken. The color varies from almost white to greenish and tan with dark markings. July 24, this species was heard singing on the white barked shrubs near Palm Canyon south of

Palm Springs, Calif. The heat was excessive and the vegetation typical of the arid regions. Only three males were taken here.

Although *O. gracilis* Davis was collected in several localities when large broods were out, no nests were found.

Okanagana nigriviridis Davis

En route to San Diego from Yuma the party camped, July 4, under some large live oak trees near the highway between Jacumba and Buckman Springs. The country is rough and the hillsides densely covered with manzanita, small oak, etc. In this locality five species of *Okanagana* were taken and two species of *Clidophleps*. None of them occurred in large numbers. The vegetation was dense and most of the songs were of short duration so that only a few specimens of each species were obtained.

The brilliant *O. nigriviridis* Davis was caught while singing in the shrubbery both in the forenoon and evening. Its song was of sufficient duration to enable the collectors to locate it while it sang. The second beat of its song was accented thus: M-ee', M-ee'. Two males and one female were taken.

Okanagana rubrovenosa Davis

One specimen of *O. rubrovenosa* Davis was taken with a net, July 4, while sweeping manzanita. Two others were located by their song.

Okanagana mariposa Davis

Four of these large males were located singing in oak, July 4, at 5 P. M. The song was loud and continuous but the specimens were wary and difficult to take.

Okanagana vanduzei (Dist.)

O. vanduzei (Dist.) sang faintly, leading one to think it was still distant when it was close at hand. Its song was noted both morning and afternoon. Five males were taken in this locality, August 4. Eighteen specimens were taken at Winters, California, August 6. Its song was heard occasionally throughout the morning and early P. M., but the specimens were located with difficulty due to the fact that the song ceased when the

collector approached. Even when located they frequently flew before they could be taken and in most cases flew high and entirely out of range. The song was high-pitched and persistent when not disturbed.

Okanagana tristis var. *rubrobasalis* Davis

In San Diego Co., one male of *O. tristis* var. *rubrobasalis* Davis was taken July 4. The song of this species is much louder than *vanduzeei* but somewhat similar to it. The louder song caused the collector to think he was immediately upon the specimen when he was some distance away.

Clidophleps wrighti Davis

Only two specimens, males, of *C. wrighti* Davis, were taken. These were singing at three P. M., July 5.

Clidophleps blaisdelli Uhler

C. blaisdelli Uhler, sang both in the forenoon and in the afternoon usually as autos passed along the highway. The song was coarse and of very short duration, usually ending as soon as the car had passed. Seven were collected in San Diego County.

Okanagana californica Distant

In the grass-covered clearings between the timber of pines, live oaks, and white oaks near Cuyamaca Lake, San Diego, Co., California, *O. californica* Dist. attracted attention by its song about nine A. M., July 6. The elevation was about 5,000 feet. Two specimens were taken on live oak shrubs but the other forty-seven were taken among the grasses. The song was faint. The specimens were easily taken with nets when located. About ten A. M. the party moved to the west side of the lake and collected a number of males in a grassy clearing. Soon two different members of the party were discovered each moving cautiously around and around in a small area in different parts of the field. In each case a male was singing, obviously very close by but the collectors could not locate him. Sensing the unusual in the situation the party concentrated on one spot and began a determined search for the elusive singer. He was finally located

singing in a hole in the ground. When disturbed he backed down the hole. Excavation revealed a vertical tunnel about six inches deep with the matured male and his discarded exuvium at the bottom. Subsequently, numerous similar instances were found. Sometimes the emergence hole was large enough to admit the escape of the adult, sometimes it was too small for either the adult or nymph to have passed. In some cases the opening was obscured. Always when an adult was found singing in the ground, his exuvium was found at the bottom of a tunnel six to nine inches in depth either placed vertical or slanting. At eleven A. M. the party moved to another clearing covered with green grass. A number of cicadas were singing here but not one was located above ground. No exuvia were found above ground in any of the localities.

This species was collected again eight miles north of Huntington Beach, July 17, on an uncultivated flat covered with weeds and grasses. The vegetation was almost brackish in appearance. The cicadas were singing here about noon either sitting on weeds and grasses or in the ground. In both localities the song was persistent and the male fairly easily located and taken. When one was frightened, however, it usually flew high and to another part of the field. Out of a total of seventy specimens only two were females.

Clidophleps distanti Van Duzee

Clidophleps distanti Van D. was first heard singing along the highway a few miles northeast of San Diego, July 8, in a habitat of chaparral similar to that where *C. blaisdelli* Uhl. was taken. The song seemed too loud for so small a cicada. It was of very short duration apparently stimulated by the passing of cars.

July 9, at Alpine, Calif., a man said twigs of the trees in his young orchard looked as though they had been sewed on a sewing machine. Inspection showed the twigs to be filled with nests of *C. distanti* Van D. As many as ninety nests placed in a straight line were counted in a length of one and a half feet of twig. The punctures extended just under the bark raising it enough to form the nest. Twelve eggs were placed in pairs in each nest. Peach, plum, cedar and citrus trees were used as hosts. When the host withered the eggs shriveled.

Cacama crepitans Van Duzee

As the party moved northward from San Diego, July 14, along highway 101, within sight of the ocean much of the way, a large brood of *Cacama crepitans* Van D., was discovered. Near Oceanside, California, with this persistent singer rendering a noisy chorus, a half hour was spent about noon collecting a large series on a cactus covered hillside. The continuous song and the tameness of these adults made them easily located and taken with nets. The tip of the abdomen was raised gradually as the song increased in intensity and rate of vibration, and was lowered as the song decreased. A female was observed ovipositing in the stem of a dead weed about one-eighth inch in diameter. She had placed four large white eggs almost in single file in a nest. The nests were so close together that they made almost a continuous line of eggs down the pithy center. This series contained eight nests. Eleven days later these eggs were in good condition. It seems probable they would develop and hatch in the laboratory just as the eggs of *C. valvata* Uhl. did.

This species was out in numbers also on the desert hills surrounding Irvine Park ten miles northeast of Santa Ana, California. They sang persistently from eight thirty in the morning until one in the afternoon but did not sing at all in the late afternoon, July 15 and 16, although the sun shone brightly.

Okanagana consobrina Distant

O. consobrina Dist. was first heard, July 21, singing along the roadside near the Rangers cabin twelve miles north of Idlewild, California. Two males were located by their song about noon and captured. They sang continuously but were so wary that they were taken with difficulty even when located. Eighteen males and three females were later taken at Winters, and near Sacramento, California. In both latter localities they were less wild. Great variation in color was noted among the adults taken near Sacramento. A cage was formed from mosquito netting over a large green weed containing many nests of cicada eggs which were thought to be laid by this cicada. A light colored male and dark colored female were placed in this cage in the hopes that some data might be obtained on the mating of dis-

similar colored specimens. The males sang almost incessantly throughout the afternoon during the fifty-mile drive and while the car was stopped at various times. No data were obtained on copulation.

The nests in the weed were an interesting study. Three freshly made nests were thought to have been made by the female in captivity. In these the eggs were white. The older nests were in series of from two to twenty-one. The nests usually contained eight eggs. Most of these eggs were pink with dark eye spots plainly visible.

Okanagana pallidula Davis

O. pallidula Davis occurred in great numbers south of Bakersfield, California, July 24, in large patches of a light-colored bushy weed, from a foot to two feet tall, which were growing near the highway. The cicadas were very numerous on this weed and many exuvia were found clinging to clods in a nearby field. The males sang persistently and were easily taken with nets. One male was located singing in the ground just as specimens of *O. californica* were found. The adult was taken three inches below the surface and the exuvium was found down about two feet.

Again, on August 1, this species was singing along the highway both south and north of Merced, California. Several specimens were taken in the short grass covering the airport northwest of town. It was also very common at Winters, California.

Okanagana utahensis Davis

In the same locality near Bakersfield, California, where *O. pallidula* Davis was collected, three males of *O. utahensis* Davis were taken. The song of this species is much louder than that of *pallidula*. The brood here was very small and only a few males were heard.

Clidophleps pallida Van Duzee

C. pallida Van D. was first heard at Lemon Cove, California, July 26, singing in a grape vineyard. Later in the evening it sang in the live oak trees in a camp site near a stream east of

Three Rivers. Frequently, en route to the Giant National Forest, the short, harsh, song of this elusive cicada would bring the party to a halt only to cease before any one could locate the singer. Its song was heard frequently up to 4,000 feet elevation and it was thought probable that it was this species which was heard once at 5,000 feet elevation in the edge of the Giant Forest. It was not until the party was descending the mountain road from the Park toward Three Rivers, however, and stopped to collect, a few hundred feet above a construction gang who were using a large truck in building the new road, that the collectors succeeded in taking any of this species. Its song is of very short duration, stimulated undoubtedly by the sound of a running motor or by the song of other males of its species. It was almost impossible to locate them by their song because of its brevity but frequently one could follow the short clucks which are often made at intervals between songs. This cluck resembles, somewhat, that frequently made by birds. This habit of clucking between songs seems to be typical of many species of Clidophleps, but in this species the sounds are a little farther apart and continued over a longer period than most of the others observed. Some of the specimens were taken with nets, some shot, and some taken with fingers after climbing a tree to reach them. One pair was observed mating, and taken in the latter manner about fifteen feet above ground. Song was noted from eight A. M., until night.

This song was heard occasionally at Winters, California, and three specimens were secured with difficulty.

Okanagana tristis Van Duzee

In the same habitat where *C. pallida* Van D. was first taken occurred the persistent singer *O. tristis* Van D. The vegetation was so dense that several specimens were frightened away before they could be located. Only one male was taken. When the singing male is approached, he ends his song in a series of fluttery clicks.

Okanagana rimosa Say

One male specimen of *O. rimosa* Say was shot while it was singing in a pine tree near the highway west of Carson City,

Nev., August 8. Its song was rather low pitched and loud, and continued for several minutes.

In view of the fact that over 800 specimens had been taken on the first part of the trip it is interesting to note that only four were collected after the party left Lake Tahoe, California, although they were especially sought. Exuvia were found occasionally and also nests of mature eggs. These eggs were pink and showed red eyespots and tarsal claws. One adult was heard at Beaver, Utah, but eluded the collectors. The scant evidence seemed to indicate that the cicadas in the high altitude of Utah, Nevada, and Colorado appear early in the season and the eggs mature and hatch before winter.

SOME OBSERVATIONS ON THE LIFE HISTORY OF
THE TOMATO PSYLLID (PARATRIOZA
COCKERELLI SULC.) (HOMOPTERA)

BY RUSSELL S. LEHMAN, M. S.

The experiments in this investigation were conducted in the insectary of the Colorado Agricultural College under the supervision of Dr. C. P. Gillette. The tomato psyllid is only occasionally injurious in Colorado. In addition to being injurious to the tomato plant, the insect is also found occasionally in large enough numbers to be injurious to the potato plant.

METHOD OF PROCEDURE

The psyllids used for this investigation were obtained from the college greenhouse and they were allowed to infest tomato plants about two feet high of the climbing variety. The psyllids on these plants were then allowed to multiply. These were used as a source of material for conducting individual observations which were performed as follows. The adult females were placed in glass tubes about ten inches long and four inches in diameter closed at both ends with cheese cloth. A fresh tomato leaf was placed in each of these tubes every day until eggs were laid and then fresh leaves for the nymphs when they emerged. Two series of experiments were conducted with small tomato plants covered with a glass chimney. Several females were confined and then removed after the eggs were laid. Observations were also made on the large tomato plants. In the two series of experiments mentioned, observations were made every few hours so that an accurate account of the habits, egg laying, and the length of the instars was obtained.

RESULTS AND DISCUSSION

The results given in table I were conducted in the insectary where there was a wide range of temperature from 10° to 35° C., while those in table II were conducted at a temperature of from 16° to 27° C.

TABLE I

Cage	Length of egg stage		Ave. length of egg stage	Plant	Life of nymphs		Tube	Life of adult	
	Days	Hrs.			Days	Days		Days	Days
3	6-7		6-7	2	29	24	2	13	13
5	6-7			1	22-23		3	10	
7	6	4		3	28		5	9	
Tube				Cage					
5	6	3		6	18		6	19	
6	6			6	22-23		7	13	
8	6			8			12	10	
10	6-7						15	14	
15	6	6					16	13	
16	7						17	15	
17	7	3							

TABLE II

Cage	Length of egg stage		Life of nymphs	Length of stadia									
				1st		2nd		3rd		4th		5th	
	Days	Hrs.	Days	Hrs.	Days	Hrs.	Days	Hrs.	Days	Hrs.	Days	Hrs.	
			Days.										
1	5	12	16	3	21	3		1		1		1	1½
2	5	5	17	3	20	3		1	20	1	4	1	

In cage 1 the adults appeared four days twelve hours after the sixth molt. The adults laid eggs three days after emergence. The length of the life cycle in cage 1 was therefore twenty-five days from the time the egg was laid until the adult deposited an egg.

In cage 2 the adults died before eggs were deposited. This was probably because of starvation, since the plant on which they were had withered.

THE EGG

Although the eggs were observed most anywhere on the leaf and stem, they are usually deposited near the edge on the upper surface of the leaf, and always on a stalk. One of the females which was confined in a tube laid an egg on the cork. An egg deposited on the glass of the tube was also observed. In addition to eggs being found on the leaves and stems of growing plants, they were also noticed on the calyx of the tomato. The number of eggs deposited by a female at one laying varies considerably, but deposits of a dozen were frequently observed.

The eggs, elliptical in shape, are a light yellowish color when first deposited except for one end being orange in color. As the eggs become older they turn more of an orange color. The following data shows measurements that were made of the eggs about ready to hatch.

Egg	Length in mm.	Width in mm.
1	.33	.155
2	.357	.148
3	.33	.155
4	.345	.142
5	.345	.155

The length of the stalk to which the egg is attached is .213 mm. The adult is usually able to deposit an egg in a minute or two, but sometimes the female seems to have difficulty in deposition of the egg and the time required may be five or more minutes.

Eggs that are not fertile do not seem to hatch but appear to dry up. Much more data would have to be obtained on this before definite conclusions could be drawn since temperature conditions may have affected the results.

THE NYMPHS

The nymphs upon hatching are yellowish in color with the posterior end orange. They have three pairs of legs and two projecting horns on the ventral surface near the head. The nymphs seem to be ready to feed immediately upon emergence from the egg. They seem to prefer the under surface of the leaf and usually move to the under surface if the eggs were deposited on the upper surface. The nymphs do not usually move around very much, but they were observed leaving a perfectly good leaf which was not very crowded. If the leaf becomes withered, they will immediately move to another leaf or the stem.

The data given below is measurements of the nymphs in different stages.

The number of molts seems to depend upon the food supply and temperature. The highest number of molts observed was six, and the fewest four. The length of each stadium has been given in the first table of observations. The nymph changes to a green color after the third molt. The nymph does a lot of wiggling but the reason for this was not determined. However this wiggling occurred just before they were ready to molt and was probably to loosen the skin before molting.

THE ADULT

The adult upon emergence from the last nymphal skin is green in color. The wings, which were white with slight brownish color, were folded under and appeared to be blown up. Four minutes after emergence the tips of the wings were still brownish in color. The eyes, which appeared to be lavender in color, were at the front, but five minutes after emergence they were at the side of the head. The body was green with the legs practically colorless with the exception of a slight brownish tinge. Eight minutes after emergence the wings were colorless. Ten minutes after emergence the wings were entirely expanded. The adults which are green upon emergence turn brown the second day and the third day they are black. This is their normal development. If the adult is injured or its wings are caught they may not change to a black color for as long as a week.

Nymph	Nymphs not over 15 hours old			Nymphs after first molt		Nymphs after last molt	
	Length	Width at eyes	Width at widest part	Length	Width at widest part	Length	Width at widest part
1	.381 mm.	.19 mm.		.541 mm.	.333 mm.	1.791 mm.	1.125 mm.
2	.381 "	.19 "		.583 "	.333 "	1.833 "	1.125 "
3	.357 "		.213 mm.				
4	.369 "		.213 "				
5	.381 "		.213 "				

Nymph	Nymph yellow, about ready to turn green		Nymphs just turned green	
	Length	Width at widest part	Length	Width at widest part
1	.958 mm.	.583 mm.	1.083 mm.	.75 mm.

In copulating the male and female are alongside of each other and the male twists its abdomen around to the female.

The adult measures 2.75 mm. from the head to the tip of the wing. The length of the body varies from 1.333 mm. to 1.666 mm.

The following table gives data collected on the egg laying of the females.

Tube	No. of eggs	Length of life
3	55	10 days
6	60	19 "
16	93	15 "

The female is not easily disturbed from her egg laying. She seems very intent on depositing the egg regardless of the circumstances or annoyances that may occur.

CONCLUSION AND SUMMARY

The damage is done to the plant by the nymphs and there is not much harm to the plants if they are fairly large. The small plants are killed outright if the infestation is heavy. The leaves of the large plants wilt if the nymphs are in great numbers. *Paratrioza cockerelli* must be present in large numbers before any damage to the plant would be noticeable. Their presence is shown very clearly by a white substance exuded from the anus of the nymph and adult.

The length of the life cycle of *Paratrioza cockerelli* varies with temperature, but at a temperature of from 16° to 27° C. the complete life cycle requires 25 days. The adult female lays on an average seventy-five eggs, with an average length of life of about fifteen days.

MORE ABOUT DOCTOR BRICKELL'S "NATURAL HISTORY OF NORTH CAROLINA"

BY HARRY B. WEISS

NEW BRUNSWICK, N. J.

When I wrote my little account entitled "The Entomology of Doctor Brickell's 'Natural History of North Carolina' " for the June, 1928, issue of this Journal, volume III of Meisel's "Bibliography of American Natural History" had not made its appearance, and being unfamiliar with ornithological literature I was unaware of the "List of Faunal Publications Relating to North American Ornithology" by Elliott Coues. Both of these bibliographies make it plain that John Brickell, M.D., was not the author of the book in question and that he brazenly appropriated the work of John Lawson. I knew, of course, that book piracy existed in early days and that it flourished even after the Copyright Act of Queen Anne (1709-10), but I naïvely supposed that naturalists could never be guilty of such a practice.

John Lawson, the rightful author, was a Scotchman who had been sent to America in September, 1700, as surveyor-general of North Carolina. He explored the Carolinas with a party of five white men and four Indians, traveling on foot and by canoe and accumulating much knowledge about the Indians and the natural history of the area in connection with his duties as a surveyor. It is stated that the natives eventually became suspicious of his operations and that he was put to death in 1712 by the Tuscarora Indians. Goode states that he was burnt at the stake in 1709. A Swiss Baron de Graffenreid seized at the same time was permitted to ransom himself. William Byrd, in his "History of the Dividing Line between Virginia and Carolina" (ed. 1866, p. 174, 214), said that Lawson "was waylaid and had his Throat cut from Ear to Ear."

Lawson's impressions and observations were recorded first by him under the title "Journal of 1000 Miles! Travel among the Indians, with a Description of North Carolina." This appeared,

according to Allibone, in quarto form in London in 1700. Then it appeared under the title, "A New Voyage to Carolina; Containing the Exact Description and Natural History of that Country; Together with the Present State thereof and a Journal of a Thousand Miles Travel'd thro' several Nations of Indians. Giving a particular Account of their Customs, Manners &c." (London, 1709). It was also issued in numbers in 1708 as a part of Stevens's "Collection of Voyages." Other London editions with slightly different title pages appeared in 1711, 1714 and 1718, and in this country it was reprinted in 1860 and in 1903. A German translation was printed in Hamburg in 1722.

In 1723, Dr. John Brickell appeared on the scene as the author of a work entitled "The Natural History of North Carolina, with an Account of the Trade, Manners and Customs of the Christian and Indian Inhabitants. Illustrated with Copper-Plates, whereon are curiously Engraved the Map of the Country, several strange Beasts, Birds, Fishes, Snakes, Insects, Trees, and Plants, &c." This was published in Dublin and later editions appeared from the same city in 1737, 1739, and 1743. Of the 1737 edition of Brickell's work, Coues said, "The material for this work was stolen from Lawson with scarcely the disguise of change of form." The fact that it was stolen four times is proof that Lawson's account must have been popular and profitable. At this date it continues to be interesting and sprightly.

In my former paper I called attention to another work by Brickell, a folio, "Catalogue of American Trees and Shrubs, which will endure the climate of England," published in London in 1739. I strongly suspect that this too was stolen from Lawson, because in the "Practical Husbandman & Planter," vol. 1, No. 2, pp. 73-112, there is attributed to Lawson a paper called "An abstract of several sorts of trees, shrubs, etc., which growing in the remotest parts of North America will undoubtedly prosper well in all parts of Great Britain; to which is prefixed a short essay concerning the easy and profitable propagation of them in our English nurseries." Apparently nothing of Lawson's was safe from Brickell or Brickell's publisher. Lawson was dead when the thefts took place, and at that time eminent lawyers argued that there were no property rights in ideas.

Mr. B. L. Robinson, who wrote in "Rhodora" in 1916, found that there were two Brickells—both physicians and both Johns. One was born in Ireland about 1749 and lived in Savannah, Georgia, for about thirty years, dying there December 22, 1809. He was a good observer of local vegetation and corresponded with and sent plants to Muhlenberg and Elliott. He also contributed papers on botany and medicine to the Medical Repository. The other John Brickell, author of the "Natural History of North Carolina," settled at Edenton, N. C., in the earlier half of the eighteenth century. J. Bryan Grimes, in an introductory note in the facsimile reprint of the "Natural History of North Carolina," published in 1911, states that although based on Lawson's work, Brickell's book is nearly twice as long and contains much additional matter on the medical side. He also says that John Brickell and his brother, Rev. Matthias Brickell, came to Carolina with Governor Burrington. John settled at Edenton and was on the grand jury of the whole province in 1731; he was also about that time a member of a mission to the Cherokee Indians, and took part in an expedition to the interior. Shortly afterward he returned to England and nothing additional on his life seems to be recorded.

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A NEW MECHANITIS (LEPIDOPTERA, NYMPHALIDAE)

BY WM. T. M. FORBES

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At the time of my revision of the genus *Mechanitis* (JOUR. N. Y. ENT. SOC., xxxii, 145, 1924) there was a single female in the U. S. National Museum which I was unable to place in any species, but which appeared either distinct or an extreme form of *mantineus*, lacking all the characters usually considered diagnostic of that species. Since then four additional specimens have come my way, including both sexes, and the form appears entirely constant and worthy of a name. As it flies with *M. polymnia* without intermixing it seems worth considering a species, though it may yet turn out to be an extreme form of *mantineus*, and there are no genitalic differences from the other members of the *polymnia* group.

Mechanitis limnaea, new species.

Elements of pattern as in *M. polymnia*, *doryssus* and *franis*. Ground solidly tawny out to end of cell, the spot in the outer part of the cell broadly connected to the base, and either solidly tawny above, or at most with a very few yellow scales, yellow beneath. Postmedial fascia as in *doryssus* and *eurydice*, taking the form of a zigzag band, with the spot in cell M_1 longitudinal and the lower half of the one in cell M_2 transverse; band separated from tawny base by heavy black markings, except very shortly just below the cell, and even there separated by the black vein, and by the abrupt and striking change in color. Black discal bar continuous, though sometimes nearly interrupted; the portion at lower angle of cell rather larger than the upper portion. Spot in outer third of cell not large, absent in one female; spot in base of cell Cu_1 also small, the postmedial spot in that cell broadly connected with the marginal black to form a thick "comma-mark," which usually fills the whole upper half of the cell submarginally, or leaves only a minute yellow spot above it, unlike the regional specimens of the *polymnia* group. Apex black, without tawny shading above or below, with a diffuse crescentic subterminal yellow band. Marginal spots white, conspicuous below, less frequently well developed above than in *M. franis*. Hind wing tawny, with the usual yellow base of costa below, but otherwise without yellow sealing; border more nearly even than

in the polymnia group, though comparable with some specimens of *doryssus*, with two teeth on its inner border to an interspace, which in some specimens are nearly equal, and never are as strikingly unequal as in those specimens of *polymnia* which have them. Postmedial band strong and continuous, only a little widened at its middle; the tawny between it and the border somewhat narrower, and also only a little widened at its middle.

Expanse about 55 mm.

The species is smaller than *polymnia*, *doryssus* and *eurydice* forms, though not smaller than *franisi* and *mantineus*. The postmedial yellow band is broader than in other specimens with an equal amount of black, the yellow area in cell M_1 being three times as long as wide; and this, with the abrupt change from tawny to yellow with the whole cell tawny, will distinguish it from all other forms of the group, I believe. There is a remarkable resemblance to "*Melinæa*" *tecta* Haensch (Seitz Macr. World, pl. 33, fig. d4, as *mnasias*), which I believe is a *Ceratinia*; but it differs in nearly or completely lacking the admarginal spots, and having a subapical yellow crescent; and also in the arrangement of the black spots in the cell and cell Cu_1 , which in *tecta* are arranged as is usual in *Ceratinia*. There is less resemblance to *M. mnasias* Hew., which is also obviously a *Ceratinia*.

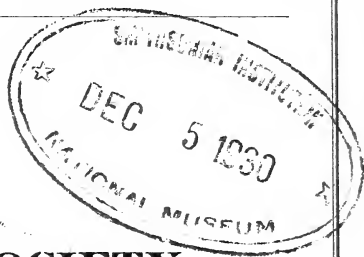
St. Laurent, R. Maroni, French Guiana, type and paratypes received through Staudinger and Bang-Haas, in Cornell University collection; and Moengo, R. Cottica, Surinam, May 23, 1927, paratype, also in Cornell University collection. There is also a female paratype in the U. S. National Museum. I caught the Moengo specimen on a small bauxite island in the enormous coastal swamp of the Guianas but have no data on the other specimens; the two localities are only about 30 miles apart.

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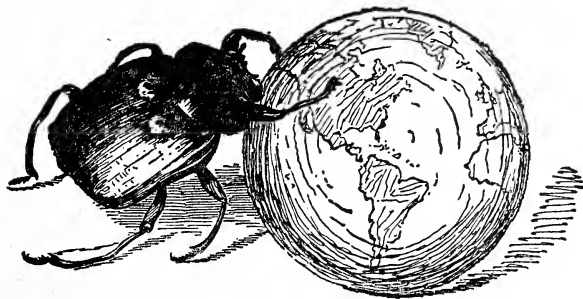
DECEMBER, 1930

No. 4

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OF THE
NEW YORK
ENTOMOLOGICAL SOCIETY



Devoted to Entomology in General



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VOL. XXXVIII

DECEMBER, 1930

No. 4

CORRODENTIA OF THE UNITED STATES OF AMERICA: I. SUBORDER ISOTECNOMERA

BY PAUL J. CHAPMAN

(Continued from page 290)

Family CAECILIIDÆ

Subfamily CAECILINÆ

Caecilius Curtis 1837

Type: *Caecilius flavidus* Stephens 1836.

Since Curtis erected this genus in 1837 it has been considerably limited by the erection of a number of genera which have a wing venational order more or less in common with the original genus. In spite of these redefinitions *Caecilius* is still a large genus, including species from many parts of the world. Cell Cu_1 of the fore wing is small—somewhat semicircular. Short hairs occur on the veins, wing margins, in the pterostigmal cell where they are exclusively confined. The terminal abdominal segments and genitalia of both sexes are weakly chitinized. They are not very useful in distinguishing the species. In the female the gonapophyses are reduced to two pairs of weak, insignificant blades; the dorsal pair may be forked or bear a lobe proximally. In the male two pairs of parameres and a penis appear to be present. The structures are symmetrical and of much more simple design than in *Psocus*.

KEY TO CAECILIUS

- 1—Wings entirely brown, or largely marked with brown; wings of ♀ sometimes reduced. Head and thorax mostly dark brown.....2
 —Wings paler, not spotted or banded, subhyaline, tan or salmon; macrop-
 terous forms only, known to exist. Head and thorax rather pale in
C. aurantiacus, tergal lobes sometimes dark brown.....3
 2—Wings uniformly brown, length about 2.5 mm. or more.....*confluens*
 —Wings of ♂ about 2.0 mm. long, hyaline, marked with brown; ♀ usually
 subapterous*posticus*
 3—Length of wings about 3.0 mm. (♂ sometimes about 2.7 mm.).....4
 —Wing length about 2.3 mm.7
 4—Ocellar interval pale, concolorous with surroundings. In ♀ lateral
 chitinized strips (not conspicuous) on subgenital plate.
quillayute n. sp.
 —Ocellar interval dark brown or black. Subgenital plate weakly chiti-
 nized throughout5
 5—Wings in distal half of fore wings brown, in distinct contrast to pale
 basal portions; cell 2A brown. Dorsum of thorax usually much more
 deeply colored than sides*aurantiacus*
 —Veins in distal half not in contrast to those in proximal half; cell 2A
 not darker. No sharp contrast between intensity of color on dorsum
 and sides of thorax6
 6—Head pale with a pair of distinct reddish or brown spots—one on each
 side of the ocelli*pinicola*
 —Head pale, markings obscure. Wings of ♂ longer than ♀.
perplexus n. sp.
 7—Wings subhyaline. Vein 1A not haired*subflavus*
 —Wings tan or salmon, veins same. Ocellar interval usually not darker
 than surroundings. Hairs on vein 1A*croesus* n. sp.

Caecilius aurantiacus Hagen

Psocus aurantiacus Hagen. Syn. Neuropt. of North Am., p.
 10. 1861.

Caecilius aurantiacus Hagen. Verh. zool.-bot. Ges. Wein 16:
 205. 1866.

Female:

Length of body 2.4 mm. ave. of 10 individuals.

Length of fore wings 3.0 mm. ave. of 10 individuals.

Length of antennæ 2.8 mm. ave. of 10 individuals.

Body mostly dull white; dorsum of head and thorax marked
 with brown; wings tan, veins brown in distal half, pale in proxi-
 mal half.

Head: Vertex with a triangular light brown area centering on the epicranial suture—the apex at the clypeal margin; *interval between the ocelli black or dark brown*; clypeus faintly lineated with broad, mesally directed tan lines which fade anteriorly; remainder of head unmarked. Maxillary palpus pale throughout. Segments 1–3 of antennæ pale brown, remainder darker, in some individuals deep brown. Eyes small, black.

Thorax: Tergal lobes brown, ranging from a golden brown to a dark brown; sutures and pleuræ dull white, tinged sometimes with tan. Legs pale; second tarsal joint light brown, claws dark brown. Wings (Pl. XXI, Fig. 14) uniformly light tan or salmon. *Typically the brown veins in distal half of wing in distinct contrast to the pale proximal portions*; narrow margins of brown accentuate the contrast in some individuals. Cell 2A uniformly light brown. Pterostigma opaque, roughly isosceles triangular in shape but R_1 gently rounded. Hind wing pale, likewise the veins.

Abdomen dull white throughout. Genitalia weakly chitinized, structures not readily visible in unstained material (Pl. XVI, Fig. 10). The subgenital plate is the not greatly modified 7th sternite; distal margin rather narrow, slightly concave and indefinitely cleft midway while the lateral angles are drawn out slightly. The median part of the plate is beset with numerous long spines while laterally the spines shorter. The gonapophyses consist of two pairs of long, very slender, sharp pointed, nearly parallel blades. A widening at the base of the caudal pair probably indicates a vestige of the lateral gonapophyses—the blade-like portion being the dorsal gonapophyses. The distal half of the lateral surfaces of paraprocts pilose.

Male:

Length of body 1.8 mm. ave. of 10 individuals.

Length of fore wings 2.7 mm. ave. of 10 individuals.

Length of antennæ 2.8 mm. ave. of 9 individuals.

The male is considerably paler throughout than female, eyes about three times as large, bluish black. Wings pale; veins brown distally, pale proximally. Body white, not as strongly marked as female. Abdomen slender, curved upwards.

Genitalia (Pl. XVI, Fig. 2) rather weakly chitinized but the triangular shaped ensemble of penis and parameres usually readily visible. The hypandrium broadly joined and seemingly contiguous with the tergite; the median portion clothed with hairs which are shortest in the caudo-mesal part; the caudal margin is gently rounded. The penis and parameres form a triangular structure as in other Caeciliidæ; the two pairs of parameres occupy the distal half; the inner pair are slender, highly chitinized, and fused distally; the outer pair are less strongly chitinized, scroll-like, abruptly pointed. The basal arms almost meet midway. Viewed *in situ*, the portion lying between the bases of the clypeus (penis?) shaped as the letter Y. The paraprocts flat, pilose in caudo-mesal area. Sense tubercles rather small, dark, much elevated.

New York: Ithaca, July 5, 1926, 3 ♀; July 11, 1926, 15 ♀ 1 ♂; Aug. 1, 1926, 19 ♀ 3 ♂; Aug. 6, 1926, 2 ♀; Aug. 8, 1925, 8 ♀ 1 ♂; Aug. 24, 1924, 4 ♀; Sept. 12, 1925, 1 ♀ laying egg in crevice on bark of maple; Sept. 26, 1926, 2 ♀; Oct. 5, 1926, 1 ♀ sweeping grass (P. P. Babi); Danby, Oct. 19, 1927, 27 ♀; Enfield Glen, Tompkins Co., Aug. 23, 1925, 14 ♀ 7 ♂; Freeville, Oct. 12, 1924, 2 ♀; Woodwardia Swamp, Tompkins Co., Aug. 10, 1924, 7 ♀; McLean Res., July 16, 1924, 2 ♀, July 31, 1926, 1 ♀; Chapel Pond, Essex Co., Sept. 19, 1925, 4 ♀ (S. C. Bishop); Avalanche Lake, Essex Co., Sept. 2, 1927, 5 ♀ 3 ♂; July 25, 1925, 1 ♀ 1 ♂ (C. R. C.); Adirondack Lodge, Essex Co., Sept. 2, 1927, 4 ♀; Mt. McIntyre, Essex Co., Sept. 4, 1927, 1 ♀ at about 4300 ft.; Jabes Pond (Lake George), Sept. 11, 1925, 4 ♀ 1 ♂ (M. D. Leonard); Michigan Mills, Lewis Co., Sept. 1, 1926, 9 ♀; Parkers, Lewis Co., Sept. 2, 1926, 4 ♀; Whetstone Gulf, Lewis Co., Sept. 2, 1926, 12 ♀; Nigger Pond, Oswego Co., Sept. 3, 1926, 7 ♀ 1 ♂; Saratoga Springs, July 14, 1926, 1 ♀; Paul Smiths, Aug. 31, 1927, 2 ♀; Tuxedo, Oct. 7, 1925, 1 ♀ (A. Wolf); Larchmont, Sept. 25, 1925, 7 ♀ (A. Wolf); Catskill, Aug. 17, 1925, 2 ♀; Hunter, Aug. 16, 1925, 17 ♀ 3 ♂ misc. beating; Sea Cliff, L. I., Sept. 6, 1925, 5 ♀; Baiting Hollow, Suffolk Co., Sept. 19, 1926, 2 ♀; Loucks Pond, Steuben Co., July 5, 1924, 1 ♀; Howard, July 5, 1924, 3 ♀; Bean's Station, Steuben Co., 1 ♀; Cinnamon Lake, Schuyler Co., July

4, 1924, 15 ♀, July 12, 1924, 3 ♀; Elmira, Oct. 1, 1925, 6 ♀; Painted Post, Sept. 15, 1925, 6 ♀; Hammondsport, July 6, 1924, 1 ♂; Barcelona, Sept. 19, 1925, 3 ♀; Montour Falls, Sept. 21, 1924, 10 ♀; Wellsville, Sept. 15, 1925, 1 ♀; Richburg, Sept. 16, 1925, 9 ♀; Rock City, Sept. 16, 1925, 12 ♀; Little Valley, Sept. 17, 1925, 6 ♀; Silver Creek, Sept. 18, 1925, 2 ♀; Penn Yan, July 29, 1925, 13 ♀ 4 ♂, Aug. 2, 1925, 18 ♀; Egglestone Glen, July 3, 1925, 1 ♀ (C. R. C.); Geneseo, Sept. 20, 1925, 1 ♀; Olcott, Sept. 19, 1925, 2 ♀; Ceres, Sept. 16, 1925, 3 ♀; Stow, Sept. 17, 1925, 17 ♀; West Barre, Sept. 17, 1925, 2 ♀.

Maine: Island Falls, Aug. 16, 1925, 1 ♀ (C. R. C.); Sebasticook Lake, Aug. 24, 1925, 29 ♀ (C. R. C.); Falmouth, Aug. 30, 1925, 1 ♀ (C. R. C.); Presque Isle, Aug. 26, 1925, 11 ♀ (C. R. C.); Molunkus Pond, Aug. 25, 1925, 3 ♀ 2 ♂ (C. R. C.); Houlton, Aug. 26, 1925, 6 ♀ 1 ♂ (C. R. C.); Winterport, Aug. 29, 1925, 1 ♀; Southwest Harbour, Mt. Desert Is., Aug. 31, 1926, 5 ♀ 3 ♂ (C. P. Alexander); Beech Mt., Mt. Desert Is., Sept. 12, 1926, 13 ♀ (C. P. Alexander).

New Hampshire: Meredith, Aug. 22, 1925, 5 ♀ (C. R. C.); Littleton, Aug. 19, 1925, 2 ♂ (C. R. C.).

Pennsylvania: Potters Mills, Oct. 31, 1924, 3 ♀ (C. R. C.); Roxbury, Oct. 30, 1924, 3 ♀ (C. R. C.); New Bloomfield, Oct. 31, 1924, 2 ♀ (C. R. C.); Arendtsville, Aug. 23, 1924, 1 ♀ from stomach of frog (*Hyla pickeringii* Holbrook) (S. W. Frost).

New Jersey: Englewood Cliff, Sept. 6, 1925, 2 ♀ 1 ♂.

Virginia: Blacksburg, Oct. 4, 1926, 1 ♀ (C. R. C.); Fredericksburg, Oct. 28, 1926, 2 ♀ (C. R. C.).

Kentucky: Valley View, June 28, 1925, 2 ♀; Lexington, July 5, 1925, 1 ♀ (L. Giovannoli); Quicksand, June 25, 1925, 14 ♀ 3 ♂; Mammoth Cave (outside), July 1, 1925, 2 ♀.

North Carolina: Frying Pan Gap, Oct. 13, 1926, 9 ♀ (C. R. C.); Mt. Pisgah, Oct. 14, 1926, 4 ♀ (C. R. C.); Cowee Mts., Swain Co., Oct. 15, 1926, 2 ♀ (C. & B.); Junaluski Gap, Macon Co., Oct. 17, 1926, 1 ♀ (C. & B.); Andrews, Oct. 17, 1926, 1 ♀ (C. & B.); Nantahala Gap, Macon Co., Oct. 14, 1926, 3 ♀ (C. & B.); Whitakers, Oct. 25, 1926, 1 ♀ 1 ♂ (C. & B.); Grandfather Mt., Oct. 12, 1923, 2 ♀ (C. R. C.); Jacksonville, Oct. 23, 1926, 1 ♂ (C. & B.); Blowing Rock, Oct. 10, 1923, 1 ♀ (C. R. C.).

Tennessee: Laurel Creek, Sevier Co., Oct. 8, 1926, 16 ♀ 2 ♂ (C. & B.); Bristol, Oct. 5, 1926, 2 ♀ at light of Coca-cola stand (C. & B.); Mill Creek below falls on Mt. LeConte, 27 ♀ 1 ♂ (C. & B.).

Georgia: Top of Blue Ridge at Towns and Rabun Co. line, Oct. 18, 1926, 1 ♀ (C. & B.); Dalton, 1859, 1 ♀ (Sacken). Holotype M. C. Z.

South Carolina: Sumter, Oct. 20, 1926, 1 ♀ (C. & B.).

Florida: Lake Bradford, Leon Co., April 13, 1927, 4 ♀ 5 ♂ (C. R. C.); The Glen, Marion Co., March 6, 1927, 2 ♀ (M. D. Leonard); Newnans Lake, May 15, 1926, 1 ♂ (T. H. Hubbell).

Washington: La Push, Aug. 10, 1927, 1 ♀ (C. R. Crosby); Lake Sutherland, Aug. 10, 1927, 1 ♀ (C. R. C.); Seattle, Aug. 7, 1927, 1 ♀ (C. R. C.).

Caecilius confluens Walsh

P(socu)s confluens Walsh. Ent. Soc. Phil. Proc. **2**: 185. 1863.

Caecilius confluens Hagen. Verh. zool.-bot. Ges. Wein **16**: 212. 1866.

Caecilius umbrosus Banks. Acad. Nat. Sci. Phila. Proc. **66**: 612. 1914.

Female (*macropterous*):

Length of fore wings 2.5 mm. ave. of 4 individuals.

Length of body 2.0 mm. ave. of 4 individuals.

Length of antennæ 1.85 mm. ave. of 3 individuals.

Wings uniformly brown, body predominately brown.

Head mostly brown; on vertex a pale U, ocellar interval black. Clypeus and labrum uniform brown, lineation on former indistinct. Genæ unmarked light brown. Antennæ and maxillary palpi light brown throughout. Eyes dull black.

Thorax: Brown, paling at sutures. Legs pale. Wings uniform brown, varying in intensity with individuals; pterostigma typically paler than other cells, opaque, rather deep, subangulate. Veins coarse, light brown. Hind wing light brown, unmarked.

Abdomen incompletely ringed with light greyish brown with the genitalia dark brown. Genitalia (Pl. XVI, Fig. 5) readily visible; the subgenital plate with distinct V-shaped chitinization;

on each side of the cleft apex the chitinization curls under, causing the apical margin to be semicircular when viewed directly from the rear; hairs on subgenital plate long distally, short hairs rather uniformly distributed elsewhere. Gonapophyses identical with *aurantiacus* except for the proximal shape and attachment of the dorsal pair. It presents a slightly concave margin to the tergite and is attached at a point midway; a dorso-lateral portion large, nearly square, with one spine at distal margin. Sense tubercles on paraprocts large, distinct. Suranal plate uniformly chitinized, blunt pointed, triangular, without distal row of long stout spines as in *posticus*.

Female (*brachypterous*):

Length of fore wings 1.0 mm. ave. of 8 individuals.

Venation reduced, cells distorted; deeper colored; pterothorax smaller; otherwise as *macropterous* forms.

Male:

Length of fore wings 2.65 mm. ave. of 6 individuals.

Length of body 1.65 mm. ave. of 6 individuals.

Length of antennæ 2.4 mm. ave. of 6 individuals.

Differs from female in the much larger size of the eyes, the slightly stouter antennæ, the paler more uniform brown of the wings and the slender upward-curved abdomen.

Genitalia (Pl. XVI, Fig. 3) typical of genus. Suspended between the parameres a diamond shaped structure composed of four parts including the penis. A basal plate is circular in outline, a pair laterally, triangular. What may be the penis lies between the lateral plates and extends toward junction of inner clasper. This part is bipartite—a pair of closely appressed spindle-shaped lobes. Chitinization on hypandrium weak, midway; distal margin definite, convex; slightly pilose laterally. Suranal plate produced into a small much elevated knob distally.

New York: Woodwardia Swamp, Tompkins County, August 10, 1924, 10 ♀ (6 *brachypterous*) 3 ♂; Fairhaven, Sept. 7, 1924, 4 ♀ (3 *brachypterous*); McLean, July 16, 1924, 4 ♀ (*brachypterous*); Hunter, Aug. 16, 1925, 2 ♀ (1 *brachypterous*); Ithaca, Aug. 14, 1924, 1 ♀ 2 ♂; Sept. 23, 1924, 1 ♂; Hillside, Fulton Co., 1 ♂. Holotype of *Caecilius umbrosus* Banks. M. C. Z.

Caecilius croesus new species

Female:

Length of body 2.0 mm. ave. of 7 individuals.

Length of fore wings 2.3 mm. average of 7 individuals.

Length of antennæ 1.7 mm. average of 7 individuals.

Superficially resembling *Lachesilla rufa* in size and coloring.

Head and thorax concolorous, a light golden brown or tan; dorsum clothed with hairs and only slightly darker than sides and venter. *Ocellar interval concolorous with surroundings*. Head unmarked, lineation on clypeus obscured, eyes dull black. Antennæ stout, concolorous with head.

Wings (Pl. XXI, Fig. 7) pale salmon and veins almost concolorous. The veins would be less distinct were they not indicated by the rather long dark hairs along their course. *Vein 1A beset with hairs unlike other members of the genus*; cell 2A no darker than remainder of wing.

Abdomen paler than head and thorax although not white. The terminal segments and genitalia resemble *aurantiacus*, especially the gonapophyses. The hairs on the subgenital plate are possibly more sparse.

Male:

Length of body 1.5 mm.

Length of fore wings 2.3 mm.

Length of antennæ 2.0 mm.

Almost identical with female in coloration. Eyes much larger, antennæ stouter and the abdomen slender, curved upward.

The genitalia resemble *aurantiacus* except the ensemble of parameres and penis is very weakly chitinized and the part between the parameres does not resemble the letter Y.

North Carolina: Lake Waccamaw, Oct. 21, 1926, 8 ♀ 3 ♂ (C. & B.). Holotype (♂), Allotype and Paratypes.

New York: Artist Lake, Suffolk Co., Sept. 19, 1926, 3♀ 2 ♂ on larch (Paratypes); Penn Yan, Aug. 2, 1925, 5 ♀ 6 ♂; Montour Falls, Sept. 26, 1924, 7 ♀ 3 ♂.

Kentucky: Quicksand, June 25, 1925, 3 ♀ 1 ♂; Valley View, June 28, 1925, 1 ♀ 1 ♂; Brooklyn Bridge, June 29, 1925, 2 ♀ 2 ♂.

Caecilius perplexus new species

Female:

Length of body 2.4 mm. ave. of 5 individuals.

Length of fore wings 3.1 mm. ave. of 5 individuals.

Length of antennæ 2.1 mm. ave. of 4 individuals.

Almost identical with *cræsus* in coloring including the wings (Pl. XXI, Fig. 6). Differs in being larger and that the ocellar interval is invariably dark brown. The terminal segments including the gonapophyses appear almost identical with *aurantiacus*.

Male:

Length of body 2.0 mm. ave. of 4 individuals.

Length of fore wings 3.4 mm. ave. of 5 individuals.

Length of antennæ 3.1 mm. av. of 4 individuals.

In general similar to female, with the usual differences in size, eyes and antennæ; wings deeply colored. Genitalia resembling *cræsus*; the structure lying between the parameres weakly chitinized, consisting of several indistinct lobes but not resembling the letter Y.

Colorado: Pingree Park, Aug. 20, 1924, 20 ♀ 7 ♂ (C. R. C.). Holotype (♂), Allotype and Paratypes; Cascade, Aug. 28, 1924, 1 ♀ (C. R. C.).

Wyoming: Yellowsone National Park, 24 ♀ 2 ♂; Aug. 27 to 31, 1927 (C. R. C.).

Alberta (Canada): Sulphur Mts., Banff, Aug. 2, 1927, 5 ♀ 3 ♂ (Eugene Crosby).

***Cæcilius pinicola* Banks**

Cæcilius pinicola Banks. N. Y. Ent. Soc. Jour. 11: 238. 1903.

Female:

Length of fore wings 2.9 mm. ave. of 10 individuals.

Length of body 2.3 mm. ave. of 4 individuals.

Length of antennæ 2.1 mm. ave. of 5 individuals.

Head and thorax a pale tan throughout, abdomen white.

Head uniformly pale tan with the only distinct markings a pair of large reddish brown spots between ocelli and antennæ. Ocellar interval deep brown. Only a faint indication of dotted areas on vertex and lineation on clypeus. Maxillary palpus and antennæ tan, the latter deeply colored. Eyes dull bluish black.

Thorax, including legs, concolorous with head throughout, usually without any deeper pigmentation on tergal lobes. Wings a uniform tan ranging almost to a salmon. Pterostigma only moderately deep, rounded; the cell is thickened, opaque, pale. Veins uniformly pale, practically concolorous with the cells. Abdomen white. Genitalia weakly chitinized, structures not readily distinguishable in unstained material and essentially identical with *aurantiacus* in form.

Male:

Length of fore wing 2.8 mm. ave. of 4 individuals.

Length of body 1.8 mm. ave. of 4 individuals.

Length of antennæ 2.3 mm. ave. of 3 individuals.

Differing from female in that eyes are about two times larger, characteristic pair of reddish brown spots on vertex not as distinct, antennæ stouter and abdomen slender curved upward. Genitalia weakly chitinized closely resembling *aurantiacus*; no structure (except possibly the sense tubercles on paraprocts) readily visible in unstained material. Hypandrium pilose laterally but also slightly so proximally. The paramere-penis ensemble resembles *perplexus* rather than *aurantiacus* being very weakly chitinized and the penis located at a pair of elongate closely appressed lobes which are widest proximally tapering to a blunt point distally.

The presence of the reddish brown spots on the vertex was the only character found that serves to separate the species readily from others with tan or orange wings about 3 mm. long.

Virginia: Caret, Oct. 28, 1926, 1 ♂ (C. & B.); Falls Church, Oct., 1 ♀ M. C. Z. Holotype.

North Carolina: Base of Mt. Pisgah, Oct. 19, 1924, 1 ♀, Oct. 13, 1926, 3 ♀ 2 ♂ (C. & B.); Yadkinville, Oct. 9, 1923, 1 ♀ (C. R. C.); Madison, Oct. 8, 1923, 3 ♀ (C. & B.). In a dry pine wood.

Florida: The Glen, Marion Co., March 6, 1927, 3 ♀ (M. D. Leonard); Rock Bluff, April 4, 1927, 1 ♂ (C. R. C.).

Georgia: Top of Blue Ridge, Towns and Rabun Co. line, Oct. 18, 1926, 4 ♀ 1 ♂ (C. & B.).

***Cæcilius posticus* Banks**

Cæcilius posticus Banks. Acad. Nat. Sci. Phila. Proc. **66**: 1914, 612. Pl. 28, Fig. 15.

Female (*subapterous*):

Length of body 2.2 mm. ave. of 6 individuals.

Length of antennæ 2.0 mm. ave. of 4 individuals.

Head dark brown; in distinct contrast to the yellowish white abdomen and the lighter brown thoracic segments and genitalia.

Pigmentation slightly paler on vertex behind eyes; a more constant pair of triangular paler area between ocelli and base of antennæ. Epicranial suture distinct to ocelli and terminating there. Head rather narrow between eyes, flat, elongate. Clypeus, genæ and labrum uniformly dark brown except the

first may be faintly lineate in teneral individuals. Maxillary palpus pale. Antennæ pale brown fading to white distally. Eyes dull bluish black.

Thorax: Segments light brown, prothorax almost equalling other segments in size. Tergum of mesothorax twice the size of other segments. Wings reduced to minute white, slightly pilose buds. Those on mesothorax extending caudally to posterior margin of metathorax and covering the much smaller wing buds on this segment. Legs pale brown throughout.

Abdomen: Large, dull white, with broad faint stripes of orange. An elliptical thickened spot between fifth and sixth sternites. Genitalia brown (Pl. XVI, Fig. 9) distinct. Subgenital plate triangular with a pair of wide lateral stripes widening and then converging apically just behind the blunt pointed membranous non-pilose apex. The subgenital plate covered with short hairs which extend to the end of the chitinization. The gonapophyses consist of two small extremely slender pointed blades which arise at right angles to elongate parallel processes from the tergite. Sense tubercles small, brown,—located on proximo-dorsal portion of paraprocts. These pieces with lateral surface definitely chitinized, not strongly pilose. Suranal plate semicircular, chitinization increasing laterally where there are a number of large spines at or near distal margin.

Female (*macropteros*):

Length of fore wing 2.3 mm. *

Length of body 2.1 mm.

Length of antennæ 2.1 mm.

Essentially the same as *subapterous* individuals. The pterothorax is of course very large, the prothorax small. The wings are subhyaline and not as strongly marked with brown as the male.

Male:

Length of fore wings 2.0 mm. ave. of 6 individuals.

Length of body 1.9 mm. ave. of 6 individuals.

Length of antennæ 2.3 mm. ave. of 3 individuals.

Marked as female, eyes of about equal size. The wings (Pl. XXI, Fig. 20) narrow, subhyaline, strongly marked with brown.

Pterostigma long, of moderate depth distally, rounded, white. Pale or unpigmented areas occur just below and for the length of pterostigma, in distal half of cell R_5 , most of R_3 and Cu_1 , on each side of first anal vein and bordering proximal half of costal margin of wing. Veins coarse light brown; R_{2+3} comes unusually close to R_1 at wing margin. Hind wing fumose. The hairs, at wing margin especially, long.

Abdomen: The ventral thickening on 5th and 6th segments prominent. Genitalia (Pl. XVI, Fig. 11) distinct, similar to *aurantiacus*. Between the parameres a pair of lateral plates (edge uppermost viewing structures *in situ*) and a circular thickening ventrally attached to which a pair of elongate lobes which are closely appressed for two-thirds their length distally. The hypandrium with wide distal margin strongly chitinized laterally. Attachment to tergites weakly chitinized, rather narrow. Hypandrium pilose; hairs longest laterally and especially at distal margin, laterally. Paraprocts similar to female; suranal plate narrower.

New York: Sea Cliff, L. I., Aug. 1 ♂ (N. Banks) M. C. Z. Holotype. Wading River, L. I., Sept. 19, 1926 4 ♀ (*subapterous*) 4 ♂ 5 nymphs (writer and A. M. Boyce). In dry oak leaves on ground. Allotype. Baiting Hollow, Suffolk Co., L. I., Sept. 19, 1926 4 ♀ (*subapterous*) 2 ♂ (writer and A. M. Boyce). In dry oak leaves on ground; Hunter, Aug. 16, 1925 3 ♀ (*subapterous*). On stones, associated with *Bertkauia lepicidinaria*; Freeville, Oct. 12, 1924 1 ♀ (*subapterous*) (C. R. C.) sifting leaves; Clarksburg, Sept. 18, 1925 1 ♀ (*subapterous*) (C. R. C.) sifting leaves; Penn Yan, Aug. 2, 1925 3 ♀ (1 *macropterous*, 2 *subapterous*).

Maine: Sebasticook Lake, Aug. 24, 1925 1 ♀ (*subapterous*) (C. R. C.).

Connecticut: Wachocastricook Creek, Salisbury, June 29, 1930, 5 ♀ (1 *macropterous*, 4 *brachypterous*).

Cæcilius quillayute new species

Female:

Length of body 2.2 mm. ave. of 5 individuals.

Length of fore wings 3.25 mm. ave. of 5 individuals.

Resembles *aurantiacus* from which it may be distinguished as follows: most of the vertex and front and all of the clypeus a uniform pale brown or buff; interval between ocelli white; tergal lobes concolorous with markings on head; a rather wide unmarked band midway proceeding well into the median lobe of the mesothorax. The wings (Pl. XXI, Fig. 21) pale brown or salmon, the veins are slender and not margined with brown and while the veins are palest basally there is no strong contrast between the proximal and distal parts as in *aurantiacus*. Cell 2A brown.

The genitalia are definitely chitinized in parts making the *ensemble* much more distinct than in *aurantiacus*. (Pl. XVI, Fig. 1). The subgenital plate bears a pair of lateral chitinized strips while the distal part is produced into a pair of lobes with a median depression. This distal portion strongly pilose. Gonapophyses consist of two pairs of slender blades: the ventral pair more or less indefinite in outline distally while the more caudal pair bear an elongate lobe on the *proximo-caudal* margin (and which bears one or two hairs distally). The paraprocts pilose distally and likewise an area midway between the sense tubercles and the mesal surface. Suranal plate lobe-like slightly tuberculate and almost non-pilose.

Male:

Length of body 1.8 mm. ave. of 5 individuals.

Length of fore wings 3.0 mm. ave. of 5 individuals.

Closely resembles female. Eyes much larger. Abdomen slender, curved upwards. The genitalia similar to male of *aurantiacus*, especially the ensemble penis and claspers.

Washington: La Push, Aug. 10, 1927 24 ♀ 5 ♂ (C. R. C.) Holotype (♀) Allotype, Paratypes; Lake Sutherland, Aug. 10, 1927 1 ♀ (C. R. C.) Paratype; Longmire, Aug. 22, 1927 1 ♀ (C. R. C.) Paratype; Sol Duc Hot Springs, 7 ♀ 2 ♂ Aug. 12, 1927 (C. R. C.) Paratypes.

***Cæcilius citricola* (Ashmead)**

Psocus citricola Ashmead. Can. Ent. **11**: 228. 1879.

I have been unable to find the type specimens of this Florida species. From its size (.10 to .12 in.) and coloration, as given by Ashmead, it appears to belong to *Cæcilius* or *Lachesilla*. I tentatively place in it *Cæcilius*.

***Cæcilius subflavus* Aaron**

Cæcilius subflavus Aaron. Acad. Nat. Sci. Phila. Proc. **38**: 13. 1866.

It was not possible to make a critical study of this species.

Type locality "Southern Texas."

Pseudocæcilius Enderlein

Pseudocæcilius Enderlein. Ann. Mus. Nat. Hung. 1: 260. 1903.

In *Pseudocæcilius pretiosus* Banks individuals are found with a distinct r-m cross vein in fore wings and all gradations up to those where R and M are fused for a short distance. Enderlein assigns species where the cross vein is distinct to *Ptilopsocinæ*. I am including psocids with *Cæcilius*-like wing-venation in this genus where cell Cu_1 is elongate and flattened, r-m cross vein present or not, veins and wing margin bearing long hairs, *pterostigma non-angulate, non-pilose*, and veins in apical portion of hind wings and at wing margin pilose. The female genitalia in *P. pretiosus* not greatly reduced as in *Cæcilius*, three pairs of gonapophyses present. It is not clear how this genus is distinct from *Epipsocus* Hagen. In the genotype *E. ciliatus*, Hagen shows a long r-m cross vein and a pubescent pterostigma (Stett. Ent. Zeit. 1882: Taf. 1, fig. 4). Enderlein describes four new species in erecting *Pseudocæcilius*; no genotype was designated. In the species appearing first, *elutus* and *testaceus*, the pterostigma is non-pubescent, in the other two the pterostigma is figured with hairs.

***Pseudocæcilius pretiosus* (Banks)**

Cæcilius pretiosus Banks. Mus. Comp. Zool. Bul. 64: 311. 1920.

Pseudocæcilius wolcottii Banks. Mus. Comp. Zool. Bul. 65: 423. 1924.

Female:

Length of wings 2.65 mm. ave. of 10 individuals.

Length of body 2.5 mm. ave. of 10 individuals.

Length of antennæ about 2.5 mm.

Mostly creamy white throughout. A constant fuscous stripe running through the pleuræ of the thorax continuing on head through eyes to antennæ.

Head unmarked except for faint indication of orange dots in usual position on vertex and the lineation on clypeus. Maxillary palpus and antennæ concolorous with head. Eyes dull black.

Thorax: A light brown V on each segment above. Pleuræ with fuscous stripe midway. Legs pale throughout. Wings (Pl. XXI, Fig. 1) hyaline with several light brown spots. Pterostigma very long and shallow, opaque, with a pale brown spot distally, R white. Central half of cell Cu light brown, the pigmentation extending up to vein M; a small spot in distal end of anal cells. Veins coarse, pale proximally, brown in distal third of wing. Proximal to their junction, Rs and M brown (forming a V); a tendency toward union of these veins by r-m cross vein although R is frequently fused to M for a short distance. Hairs on veins and wing margin long, stout. Hind wings unmarked, veins pale.

Abdomen white with a few purplish grey stripes on dorsum. Genitalia weakly chitinized, structures not readily visible in unstained material. The basal portion of sub-genital plate (Pl. XVII, Fig. 6) about one-third as deep as wide. At proximal margin a triangular pilose area; distal margin bent to give rise to an egg-guide. This piece produced distally into a pair of lateral lobes each bearing a single spine; the egg-guide comes to a blunt point between the lobes so that the distal margin forms the letter W. A weak V-shaped plate lies beneath the egg-guide. Three pairs of gonapophyses present. The lateral pair large, swollen and lobe-like; attached broadly with the blunt pointed distal portion extending over the egg-guide; a few (about six) long spines adorn the structure. The ventral and dorsal gonapophyses of similar shape, being fleshy, slender, curved with a median, slightly chitinized "core," twisted and flattened. Distally they fork slightly. The dorsal gonapophyses bear an inconspicuous row of minute hairs distally and one or several apical teeth.

Sense tubercles of paraprocts small, much elevated proximally. Hairs at distal margin long, numbering about seven or eight. Suranal plate wide with a row of eight stout spines at distal margin.

Florida: Orlando, June 4, 1926 32 ♀ many nymphs. Common on citrus (M. D. Leonard); January, 1927 4 ♀ and May, 1927 1 ♀ (O. C. McBride).

Texas: San Antonio, 3 ♀ M. C. Z. Holotype and Paratypes; (1 ♀ Paratype kindly supplied for critical study by Nathan Banks).

Dist. of Columbia: Washington, Oct., 4 ♀. In hot house. Paratypes M. C. Z.

Porto Rico: 3 ♀ (G. N. Wolcott) Holotype and Paratypes of *Pseudocæcilius wolcottii* Banks; San Juan, 1 ♀ April 10, 1923 (G. N. Wolcott) Paratype (?) kindly supplied by Nathan Banks for critical study.

Pseudocæcilius (?) *clarus* (Banks)

Cæcilius clarus Banks. Am. Ent. Soc. Trans. **34**: 258. 1908.

No careful study was made of this species. Because wing venational characters and wing pubescence resemble *P. pretiosus*, *clarus* is tentatively placed here. The pterostigma is transparent and, I believe, nonpilose. R is joined to M for a considerable distance in the holotype. Wing length 2.9 mm. Wing markings similar to *pretiosus*. The head a dull sulphur-yellow, with a few obscure marks on vertex.

California: Berkeley, 1 ♀ on bay laurel M. C. Z. Holotype.

Teliapsocus new genus

Genotype: *P(socu)s conterminus* Walsh 1863.

Related to *Kolbea* Bertkau, differing principally in the disposition of hairs on the wings. In *Teliapsocus* large stout hairs are found along the veins *but also in the cells in proximal half of the wings and in pterostigma*. Only a few large hairs occur in the distal half of wings while the wing margin is sparsely clothed with much shorter hairs. *Hind wings un haired* except for a few at the margin in the apex. Cell Cu_1 is large, deep; vein Cu_1 almost touching M. *Brachypterous* females of *T. conterminus* have been taken.

The terminal abdominal segments and genitalia resemble *Cæcilius*: only one representative of *Teliapsocus* has been found in the United States. It is easily distinguished from others of the family Cæciliidæ.

Teliapsocus conterminus Walsh

P(socu)s conterminus Walsh. Ent. Soc. Phila. Proc. **2**: 185. 1863.

Psocus canadensis Provancher. Nat. Canad. **8**: 177. 1876.

Cæcilius definitus Aaron. Am. Ent. Soc. Trans. **11**: 38, Pl. 9, Fig. 4. 1883.

Elipsocus conterminus Hagen. Verh. zool.-bot. Ges. Wein. 16: 207. 1866.

Female (*macropterous*):

Length of body 3.8 mm. ave. of 8 individuals.

Length of fore wings 4.25 mm. ave. of 8 individuals.

Length of antennæ 2.9 mm. ave. of 7 individuals.

Head: Vertex covered with coarse fuscous markings; ocelli enclosed in a blackish spot; a U-shaped brown spot on front; clypeus short, wide, much swollen; lineated with mesally directed lines which are dark fuscous anteriorly, then tan, and finally fading out posteriorly; in some individuals the lines merge posteriorly; labrum tinged with tan and brown; genæ white with a black spot below antennæ and a similar one on maxillæ at base of maxillary palpus. Maxillary palpus white except the distal two-thirds of last segment which is brown. Antennæ brown paling proximately to faint tan or white; segments 1-4 distinctly pale with a brown ring distally on segments 3 and 4. Eyes small, dull black.

Thorax: Tergal lobes shining black, sutures white. Pleuræ white with large conspicuous black spots distributed as follows: one just below attachment of each wing; one above coxa of mesothoracic leg; one on each of coxæ. Legs: femora white with a few brown dots on outer surface; tibiæ white touched with brown proximally and distally; tarsi brown, darkest distally. Wings (Pl. XX, Fig. 29) hyaline with only small touches of brown. Pterostigma opaque; a narrow band of brown at apex and base of cell; a faint incomplete band of light brown extending from end of anal veins to base of Rs. Veins distinct, dark brown in distal half of wing, pale brown basally.

Abdomen conspicuously white with greyish and reddish brown stripes on tergum while the 9th tergite almost completely covered with two pairs of blackish spots. Subgenital plate (Pl. XVI, Fig. 8) dark brown resembling the letter π in shape. The ventral gonapophyses short, the Y-shaped gonapophyses probably represent the united lateral and dorsal gonapophyses. Sense tubercles of paraprocts white and likewise the paraprocts while at its apex three conspicuous spines, the middle one short.

Suranal plate short, triangular, white, with a pair of stout spines apically.

Female (*brachypterous*):

Length of fore wings 1.0, 1.7, 1.6 mm. Measurements of 3 individuals.

The venation of these reduced wings may usually be recognized as that of *Teliapsocus* but aberrations are common. The hairs are distinct, both those on the veins and on cells Cu_1 and A_1 .

Male:

Length of body 2.75 mm. ave. of 8 individuals.

Length of fore wings 4.35 mm. ave. of 8 individuals.

Length of antennæ 4.1 mm. ave. of 6 individuals.

Resembles female in markings, much less robust, abdomen slender. Eyes larger but not twice the size of female. Antennæ brown throughout, palest at base, not more pilose than female but stouter.

Genitalia (Pl. XVI, Fig. 4) symmetrical. Hypandrium roughly triangular, chitization V-shaped. Parameres similar to *Cacilius*. Suspended between these pieces a concave triangular piece—(the penis?). Paraprocts similar to female in that the sense tubercles are white and that similar spines appear at the apices of the structures.

New York: Chapel Pond, Essex Co., July 19, 1925, 3 *brachypterous* ♀ (S. C. Bishop); Sea Cliff, L. I., 1 ♂ (Banks) M. C. Z.

Quebec, Canada: 1 ♀ (Provancher) M. C. Z. Paratype of *Psocus canadensis*?

Maine: Winterport, Aug. 29, 1925, 1 ♀ (C. R. C.).

Massachusetts: 4 ♀ M. C. Z.

Connecticut: Bear Mt. 2300 ft. elevation, Salisbury, Aug. 22, 1902, 1 ♂ (A. P. Morse) M. C. Z.

Maryland: Plummers Island, Aug. 21, 1 ♀ M. C. Z.

Virginia: Caret, Oct. 28, 1926, 2 ♀ (C. & B.); New Market, Oct. 4, 1926, 1 ♂ (C. & B.).

Kentucky: Quicksand, June 25, 1925, 1 ♀ misc. beating.

North Carolina: North Fork Swannanoa, Black Mts., 1 ♀ M. C. Z.; Bridgewater, Oct. 14, 1923, 1 ♀ (C. R. C.); Blowing Rock, Oct. 10, 1923, 2 ♀ (C. R. C.).

Georgia: Spring Creek, Seminole Co., Apr. 11, 1927, 2 ♂ (C. R. C.); Tiger, Oct. 18, 1926, 3 ♀ (C. & B.).

Florida: Orlando, Aug. 2, 1927, 4 ♀; Jan., 1927, 2 ♀ (O. C. McBride).

Wyoming: East Entrance to Yellowstone Park, Aug. 31, 1927, 12 ♀ 6 ♂ (C. R. C.).

Washington: Longmire, Aug. 22, 1927, 12 ♀ 1 ♂ (C. R. C.).

In 1863 Walsh described *Psocus conterminus*, and, although the types are non-existent, the species is readily recognizable from his description. He made clear that cell Cu_1 was not joined to M and was "nearly in the shape of an equilateral triangle." This places it in the *Cæciliidæ*. Walsh gives the length of *conterminus* as 4.5 mm., which point alone is sufficient to distinguish it from other North American *Cæciliidæ*. Provancher in 1875 described *Psocus canadensis*. This is a synonym of *T. conterminus*; the description fits and in the Museum of Comparative Zoology there is a specimen "*Elipsocus canadensis* Prov." labelled apparently by Hagen, "Quebec, Prov." "397" and which is unmistakably *T. conterminus*. Hagen erroneously assigned *contermina* to *Elipsocus* thinking it had three jointed tarsi; and Banks likewise lists it, and its two synonyms, as distinct species of *Elipsocus* in his catalogue. *Cæcilius definitus* Aaron is a male of *T. conterminus*.

Polypsocus Hagen

Polypsocus Hagen. Verh. zool.-bot. Ges. Wein. **16**: 203. 1866.

Ptilopsocus Enderlein. Zool. Jahrb. Syst. **14**: 153. 1900.

Type: *P. corruptus* Hagen. 1861.

The unusual shape cell Cu_1 caused Hagen to erect the genus *Polypsocus* for the inclusion of the single species *P. corruptus* Hagen. Vein Cu_1 parallels the wing margin for a considerable distance causing cell Cu_1 to be very large. Wing margins, veins, pterostigma and cells in apex of wing, near margin, covered with hairs. The genitalia show an affiliation to *Teliapsocus*, *Cæcilius* and *Graphopsicus*.

Polypsocus corruptus Hagen

Psocus abruptus Hagen. Syn. Neuropt. of N. A., p. 13, 1861.

Psocus corruptus Hagen. Syn. Neuropt. of N. A., p. 13, 1861.

Polypsocus corruptus Hagen. Verh. zool.-bot. Ges. Wein. **16**: 211. 1866.

Ptilopsocus annulicornis Banks. Jour. N. Y. Ent. Soc. **11**: 238. 1903.

Female:

Length of body 3.1 mm. ave. of 10 individuals.

Length of fore wings 3.65 mm. ave. of 10 individuals.

Length of antennæ 3.0 mm. ave. of 10 individuals.

This striking psocid is readily recognized by the shining bronze wings with the hyaline band near their apex.

Head: Uniformly dull tan, mouthparts pale; a pair of dark stripes run between the base of antennæ and eyes, continuing and widening behind the eyes. Maxillary palpus tan, pale distally. Compound eyes dull bluish black. Antennæ with segments 1-4 hyaline and the remaining with a distal portion brown, the proportion of the segment colored increasing progressively, distally.

Thorax: Dorsum ranging from tan to brown, darkest anteriorly on median tergal lobe. On pleuræ a continuation of the dark fuscous stripe on head. Prothorax white below this stripe. Meso- and metathoracic legs with brown on the coxæ; femora brown, tibiæ and tarsi pale, nearly white but the tarsal claws brown. Fore wings (Pl. XXI, Fig. 12) uniformly shining dark brown except for a distinct hyaline band at the apex of the wing which would be crescent shaped, except that the extreme apex of the wing is brown. A small white spot at base of pterostigma, cells otherwise darker than remainder of wing. Veins coarse, inconspicuous. Hind wings paler, greyish brown, darkest marginally in apical third of the wing.

Abdomen: Usually a purplish grey; dorsum palest, quite pale or nearly white above in some individuals. Genitalia (Pl. XVI, Fig. 12) brown. Chitinized portion of subgenital plate V-shaped. A strip of purplish pigment, alongside each arm. The gonapophyses reduced to a single pair consisting of a lobe-like basal portion and stiletto-like distal part, while fused to their mesal margins is the interior genital plate thus making a continuous piece beneath the subgenital plate. Sense tubercles of

paraprocts large. Suranal plate long, rather narrow, truncate with distal margin strongly pigmented.

Male:

Length of body 2.45 mm. ave. of 10 individuals.

Length of fore wings 3.65 mm. ave. of 10 individuals.

Length of antennæ 3.7 mm. ave. of 8 individuals.

Hyaline portions on fore wings (Pl. XXI, Fig. 13) consistently differing from female as follows; a pale area midway, roughly diamond shaped with the extreme angles at the base of pterostigma and at Cu_1 ; the hyaline area at the tip of wing triangular with its base at the costal margin and the apex about halfway across wing. Compound eyes slightly ovate, extremely large, several times larger than female's. Antennæ stouter than female, segment 1 and 2 brown and with gradually increasing amounts of brown distally.

Abdomen usually white with the genitalia brown (Pl. XVI, Fig. 7). Hyandrium short, basal margin wide, straight across; definitely chitinized laterally but a weakly chitinized diamond shaped portion lies mesally. On hyandrium long hairs laterally, short hairs mesally. The parameres as in *Cacilius*; suspended between these lie pieces consisting of two pairs of lateral hooks and a single distal hook. Sense tubercles large, occupying the proximal two-fifths of chitinized part of paraprocts. Suranal plate small, blunt pointed, with a proximal weakly chitinized crescent.

New York: Ithaca, July 11, 1926, 13 ♀ 12 ♂ in dead leaves on fallen beech tree, Sept. 6, 1926, 19 ♀ 5 ♂ in dead beech leaves; Enfield Glen, Tompkins Co., Aug. 23, 1925, 7 ♀ 3 ♂ 5 nymphs; Sea Cliff, L. I., 3 ♀ 2 ♂ (Banks) M. C. Z.

New Hampshire: Berlin Falls, Aug. 12, 1 ♀ M. C. Z.; Franconia, 1 ♀, M. C. Z.

Pennsylvania: Pennsylvania Mts., 1860, 2 ♀ 1 ♂ (O. Sacken) M. C. Z.

Massachusetts: 1 ♀, M. C. Z.

Wisconsin: Polk Co., July, 1 ♀ 2 ♂ (Baker) M. C. Z.

Illinois: Rock Island, 1860, 2 ♀ 1 ♂ (Walsh) M. C. Z.

Virginia: Falls Church, June 8, 1 ♂. Holotype *Ptilopsocus annulicornis* Banks, Sept. 3, 8 ♀ 2 ♂, Aug. 27, 1 ♀ (Banks) M. C.

Z.; Great Falls, July 21, 1 ♂ (Banks) M. C. Z.; Delaplane, Sept. 10, 1 ♀ (Banks) M. C. Z.; Glencarlyn, May 9, 3 ♂ (Banks) M. C. Z.

Maryland: 1860, 1 ♀ (Uhler) M. C. Z.

District of Columbia, Washington: 1858, 2 ♀ 1 ♂ (O. Sacken). Types M. C. Z., 1 ♀, July 21 (Banks) M. C. Z.

Kentucky: May, 1 ♀ (Sanborne) M. C. Z.

North Carolina: Blowing Rock, Oct. 10, 1923, 5 ♀ 5 ♂ (C. & B.).

Tennessee: Mill Creek, below falls on Mt. Leconte, Oct. 10, 1926, 12 ♀ 12 ♂ (C. & B.).

Georgia: Dalton, 1859, 2 ♀ 1 ♂ (O. Sacken) Types M. C. Z.; Clarksville, Aug. 10, 1909, 1 ♀ 1 ♂ M. C. Z.

Washington: Seattle, Aug. 7, 1927, 1 ♀ (C. R. C.); Lake Sutherland, Aug. 10, 1927, 2 ♂ (C. R. C.).

The difference in markings in the sexes, especially the markings of the fore wings, caused Hagen to name the female *Psocus abruptus* and the male *Psocus corruptus*. Later he decided they were one species and not congeneric with *Psocus*. He then erected the genus *Polypsocus* with *corruptus* as the genotype. *Ptilopsocus annulicornis* Banks is a male *corruptus*.

Dead leaves of deciduous trees are known to be a favorite feeding and breeding ground of this handsome species. The writer has found oak and beech leaves so inhabited both on the ground or when still attached to a fallen tree or broken branch. A slight webbing encloses their home. *P. corruptus* also occurs on tree trunks, cliff walls and elsewhere. Two broods or more are found in New York State.

Graphopsocus Kolbe

Graphopsocus Kolbe. Jahresber. Westfäl. Ver. Wissens. 8: 125. 1880.

Type: *G. cruciatus* L. 1768.

In the fore wings of *Graphopsocus*, cross-veins r and m-cu are present and the wing margin is non-pubescent. These characters readily distinguish the genus. The genitalia are very similar to *Cacilius*, *Teliapsocus* and others. Enderlein has consistently grouped *Graphopsocus* and the related genus *Stenop-*

socus Hagen 1866, under the Psocidæ. The genitalia, however, are so similar to the Cæciliidæ that it appears to be more properly placed in that family than in Psocidæ.

Graphopsocus cruciatus (Linne)

Hemerobius cruciatus Linne. Syst. Nat. Ed. 13, T. 3, App., p. 225. 1768.

The synonymy is listed in Cat. Coll. Selys. Longchamps Fasc. 3. Pt. 2, p. 13. 1915.

Female:

Length of body 2.35 mm. ave. of 10 individuals.

Length of fore wings 2.9 mm. ave. of 10 individuals.

Length of antennæ 2.8 mm. ave. of 8 individuals.

Readily recognized by the wing markings which consist of three bands of light brown in the distal half of the wing and four large dark brown spots in proximal half.

Head: Vertex tan, marked with elongate brown dots: just behind the ocelli a pair of dotted areas composed of three or four dots; the marginal area marked with dots thus leaving a large unmarked area on each side of epicranial suture. Most of front covered by about four brown dots; a white area surrounding the antennæ, includes the anterior third of the genæ and anterior third of clypeus (half of clypeus laterally). Posteriorly the clypeus brown, lineated with broad broken lines of dark brown. Labrum touched with brown deepening mesally, with a triangular white area midway anteriorly; posterior two-thirds of genæ brown. Maxillary palpus pale, darkest proximally. Antennæ brown distally, with a gradual paling proximally so that segments 1 and 2 are white. Eyes dull black.

Thorax: Tergal lobes dark brown. On the pleuræ the epimerum and coxæ of the mesothorax brown while the sides are otherwise white or inconspicuously touched with brown and in other individuals the coxæ of the metathorax are brown. Legs: femora white, tibiæ and tarsi light brown. Wings hyaline (Pl. XX, Fig. 30) fore wings strikingly marked as figured. Veins pale proximally, brown distally. Hind wings hyaline, clouded with pale brown areas which correspond generally to the markings of fore wings. These markings are more distinct proxi-

mally while the most proximal of the spots in the anal area is dark brown.

Abdomen white, pale straw yellow or gray below. Genitalia (Pl. XVIII, Fig. 13) distinct. The subgenital plate an inverted U in shape with the arms slightly spread. The distal margin is broad, slightly concave, strongly chitinized. Ventral gonapophyses, short, slender, stiletto-shaped, obscured by the subgenital plate under which they lie. Apparently the dorsal and lateral gonapophyses combined in the pair of slender, stiletto-like rods with the elongate blunt-pointed portion arising proximally from the dorsal margin. Paraprocts and suranal plate weakly chitinized; sense tubercles on the former inconspicuous, with the latter structure triangular in outline.

Male:

Length of body 1.9 mm. ave. of 4 individuals.

Length of fore wings 3.05 mm. ave. of 5 individuals.

Length of antennæ 3.05 mm. ave. of 5 individuals.

Resembles female, but with these differences: body less robust; antennæ more robust but not more pilose; eyes large, slightly ovate, more than twice as large as females; markings paler, less distinct, especially on head and on wings; abdomen slender, curved upward.

Genitalia (Pl. XVI, Fig. 6) symmetrical. Parameres as in *Cacilius*. An indistinct triangular concave structure suspended between the parameres. Hypandrium wide, definitely chitinized, (usually chitination fades out mesally), bearing a distinct distal portion elliptical in outline and with a pilose strongly chitinized distal margin. Caudo-mesally on the 9th tergite a pair of slender pointed, mesally directed processes. Sense tubercles on the paraprocts proximal, large, distinct. Suranal plate short, membranous, triangular.

Maine: Bar Harbor, June 22, 1922, 1 ♀ (C. W. Johnson).

Washington: Seattle, Aug. 7, 1927, 13 ♀ 3 ♂ (C. R. C.). Edmonds, Aug. 16, 1927, 7 ♀ 1 ♂ (C. R. C.).

Germany: Saxony, 1 ♂ (Rostock). Supplied by M. C. Z.

This is believed to be the first American record of this species. It is common and widely distributed in Europe. *G. cruciatus* is probably not indigenous to America—at least to Eastern United

States—or it should have been found before 1922 when Mr. C. W. Johnson took it at Bar Harbor, Maine. In Washington, Prof. C. R. Crosby took specimens at Seattle and nearby at Edmonds; he was unable to find it in more isolated localities. Can these Washington specimens be representatives of an introduction from Japan or elsewhere in the Orient? (*G. cruciatus* is recorded in Japan.) The Museum of Comparative Zoology gave the author a male of this species taken in Germany. A critical examination of this specimen causes me to conclude that the American specimens are conspecific with it.

***Terracæcilus* new genus**

Type *T. pallidus* new species.

Female subapterous, the wings reduced to a single pair on the mesothorax. Male unknown. Thorax reduced, mesothorax slightly larger than the other two segments. Tarsi two-jointed. Legs not armed with ctenidia. Head broad, rather flat; ocelli apparently non-functional, being represented by three dark dots in a depression. Epicranial suture fading out at this depression. Buccal rods slender, forked apically. Genitalia resembling *Lachesilla*. The gonapophyses reduced to a single pair of arm-like pieces. Sense tubercles of paraprocts wanting.

***Terracæcilus pallidus* new species**

Female:

Length of body 2.2 mm. ave. of 7 individuals.

Length of antennæ 2.0 mm.

Head, abdomen and genitalia dull orange; abdomen paler, sternites conspicuously marked with greyish brown stripes at the sutures. Head deep orange above, paling at the genæ; clypeolus and also a V-shaped mark on the vertex, unmarked; on clypeus barely distinguishable, broad, mesally directed lines. Antennæ clothed with a few long hairs; concolorous with head together with maxillary palpus. Eyes small, dull bluish black.

Thorax: Pleuræ paler than dorsum. Wings elongate, blunt pointed apically, convex, thickened and covered with minute spines. Legs pale, concolorous with pleuræ. Tarsal claws short.

Genital processes (Pl. XVII, Fig. 7). Subgenital plate a large, V-shaped plate with a blunt-pointed, weakly chitinized apex. The single pair of gonapophyses stout, convex, blunt-pointed arms. They are sparsely pilose. Paraprocts triangular, pilose in distal half with a weakly chitinized spot at the apex. The chitinization extends beyond distal edge to form a crescent-shaped part there. Suranal plate isosceles trapezoidal with the distal margin gently rounded and pilose; proximally a thin non-chitinized crescent.

New York: Ithaca, July 12, 1925, 12 ♀ Holotype and Paratypes; Clarksburg, Sept. 18, 1925, 1 ♀, sifting leaf mold (C. R. C.); Barcelona, Sept. 19, 1925, 1 ♀ sifting leaf mold (C. R. C.).

Tennessee: Mill Creek, below falls on Mt. Leconte, Oct. 10, 1926, 2 ♀ (C. R. C.).

Lachesilla Westwood

Lachesilla Westwood. Introd. Class. Ins. 2: 19, 1840.

Pterodela Kolbe. Jahresber Westfäl. Ver. Wissens. 8: 118. 1880.

Type: *L. pedicularia*, 1758.

Wing venation as in *Cæcilius* from which *Lachesilla* differs in that the veins and wing margin are non-pilose. The genitalia are considerably different from the other members of the subfamily. In the female appears, usually, a single pair of arm-like gonapophyses; the interior genital plate is frequently distinct, and the genital structures generally, are readily visible. The male genitalia present such a great variety of form that it is difficult to homologize the several elements. A pair of stout claspers arising from the tergum or sometimes fused to the hypandrium is rather constant. A chitinized structure lying mesally below the hypandrium is considered homologous with the true parameres in other genera. It differs from the fused parameres of other genera, among other things, in the proximal portion not being paired. It hardly seems to qualify as a true penis.

Species of *Lachesilla* inhabit dead and dying leaves, but some, like *L. pedicularia* L. are found in a great variety of situations.

KEY TO FEMALES OF LACHESILLA

- 1—Arm-like gonapophyses present; fore wings unmarked3
 - Arm-like gonapophyses absent or vestigial; fore wings with brownish spots at ends of veins2
- 2—Arm-like gonapophyses absent; distal portion of interior genital plate, which is chitinized, W-shaped with the median part drawn out into lateral points*nubilis*
 - Arm-like gonapophyses appearing to be absent but very small—only an oval spot at apex readily visible; interior genital plate hexagonal, the four distal angles drawn out into points*punctata*
- 3—Wings with a distinct orange or tan cast but veins almost concolorous; abdomen not striped, usually unmarked; length fore wings about 1.7 mm.4

- Wings hyaline or with faint orange or tan cast, veins distinct, darker; abdomen usually striped5
- 4—Shape of subgenital plate not easily distinguishable in unstained specimens, but an elongate lemon yellow part of the interior genital plate readily visible*forcepata* n. sp.
- Outline of subgenital plate distinct, deep narrow cleft midway.
.....*contraforcepata* n. sp.
- 5—A short, wide, forked plate medianly, the unbranched basal half fused to subgenital plate; subgenital plate rather indistinct; length of fore wings between 2.2 and 2.8 mm.6
- A single slender prong midway distally on subgenital plate; subgenital plate distinctly chitinized, a less highly chitinized diamond-shaped part distally; length of wings about 2.0 mm.*corona* n. sp.
- No prong or forked plate fused externally to subgenital plate; either small (length of wings 1.7 mm.) and subgenital plate distinct in outline or wings about 2 mm. long, genitalia as in *forcepeta*8
- 6—Interior genital plate strongly chitinized, roughly hexagonal; subgenital plate less highly chitinized, strongest laterally; forked plate indistinct, slender; length wings 2.7 mm.; gonapophyses arise directly from the tergite*rufa*
- Interior genital plate indistinct, forked plate wide, short; gonapophyses fused to a plate which is probably a continuation of interior genital plate7
- 7—Distal half of veins in fore wing brown, in striking contrast to the pale basal portion; length fore wings 2.7 mm.; subgenital plate wide, of definite outline; gonapophyses with nearly circular basal attachment and almost covering plate to which they are fused.....*arida* n. sp.
- Veins pale throughout; length of wings 2.2 mm.; subgenital plate weakly chitinized; plates to which gonapophyses fused extending considerably caudo-laterally from base of gonapophyses.....*silvicola* n. sp.
- 8—Form of subgenital plate readily visible; length of wings 1.7 mm., or shorter9
- Form of subgenital plate indistinct, elongate, yellowish portion of interior genital plate visible, length of fore wings 2.0 mm.; abdomen somewhat striped.....*forcepeta* var. *major* n. sp. and n. var.
- 9—Head with the usual group of dotted areas on vertex distinct; wings subhyaline; a small plate with a large triangular cleft basally, fused to apex of subgenital plate below; abdomen not definitely striped.
.....*pacifica* n. sp.
- Head uniformly golden brown or dark brown; wings hyaline; abdomen typically ringed with gray*pedicularia*

KEY TO MALES OF LACHESILLA

- 1—Hyandrium greatly reduced; pincer-shaped arms give rise distally to long, slender claspers; fore wings with spots at end of veins.....2
- Hyandrium large, or of moderate size; wings unmarked.....3

Resembles *silvicola* in general appearance and markings and is closely related to it. Wings hyaline. Veins in proximal half of wing pale yellow, in distal half brown, thus producing a rather unusual contrast. M joined to Cu for a short distance or by a short cross-vein. On the abdomen occur the side markings of grey as in *silvicola* but an occasional dorsal mark may be found.

Genitalia (Pl. XVII, Fig. 8) fairly distinct without staining. Similar to *silvicola* with the following differences: the subgenital plate is of definite outline being very broad but with a basal cleft midway; lateral margin sloping mesally beyond the attachment, while the distal margin is rather narrow, straight across. The pair of gonapophyses large, nearly circular at the base, almost covering the lateral part of the plate to which they are fused; the distal part slender, blunt-pointed and considerably more caudally than mesally directed. Sense tubercles on paraprocts dark purple.

Arizona: Ramsey Canyon, Huachuca Mts., Sept. 2, 1927, 6 ♀, in dead oak leaves (J. D. Hood.). Holotype and Paratypes.

***Lachesilla contraforcepeta* new species**

Female:

Length of body 1.65 mm. ave. of 7 individuals.

Length of fore wings 1.7 mm. ave. of 7 individuals.

Length of antennæ 1.1 mm. ave. of 7 individuals.

Resembles *forcepata* from which it may be distinguished by genitalial characters. Head and thorax tan, abdomen dull white. Head and appendages generally tan with the dotted areas of the vertex a little darker tan; genæ pale; the clypeus indistinctly lineated. Antennæ become darker distally. Eyes dull bluish black.

Thorax including legs, tan, rather pale on dorsum, with sutures brown on the pleuræ; femora pale. Wings (Pl. XXI, Fig. 19) unmarked, uniformly faint tan or salmon. Pterostigma opaque, veins inconspicuous, tan. Hind wings almost hyaline.

Abdomen usually dull white, but touched with purplish grey on the sides. The subgenital plate (Pl. XVII, Fig. 10) unlike *forcepeta*, is distinctly visible, being broad, with a narrow deep "cleft" extending two-thirds of its length; the distal margin wide and slightly concave, while the lateral margin beyond the attachment bevelled. The subgenital plate pilose except for a pair of small triangular lateral pieces distally. The interior genital plate obscured by subgenital plate; the puncture is defined by a rather wide chitinated ring. Gonapophyses bent strongly mesally, narrow proximally and distally. Sense tubercles of paraprocts purple, small. Suranal plate purplish, short, gently rounded distally.

Male:

Length of body 1.5 mm. ave. of 7 individuals.

Length of fore wings 1.8 mm. ave. of 7 individuals.

Length of antennæ 1.25 mm. ave. of 7 individuals.

Resembles the female closely; eyes and antennæ not appreciably larger, abdomen slightly less robust. In this species the claspers (Pl. XVIII, Fig. 4) curve first mesally but bend out again to point laterally. Their direction is directly opposed to the mesal direction of the claspers in *forcepeta* which point serves as a ready means of distinguishing between

the two species. The basal three-fifths of the claspers considerably broader than the distal two-fifths; terminally, the piece has a foot-like enlargement. The hypandrium a rather short plate with a convex distal margin; lying directly ahead a pair of small, short, nearly triangular plates which end in a rounded lobe-like part; the interval between these plates rather narrow, deep and angular at the base. The parameres fused to form a notched rod. Paraprocts give rise to slender curved mesally directed plates.

New York: Ithaca: Aug. 22, 1926, 23 ♀, 7 ♂, 2 nymphs, on red cedar; Aug. 8, 1925, 9 ♀, 8 ♂, in dry leaves; July 11, 1926, 1 ♀ in dead leaves on fallen tree, Holotype (♂) Allotype and Paratypes; Enfield Glen, Tompkins County, Aug. 23, 1925, 2 ♀, 2 ♂; Danby, Oct. 19, 1924, 1 ♂; Montour Falls, Sept. 21, 1924, 1 ♀.

Maine: Sebasticook Lake, Aug. 24, 1925, 1 ♀ (C. R. C.); Wintersport, Aug. 29, 1925, 1 ♀, 1 ♂ (C. R. C.).

Virginia: Blacksburg, Oct. 4, 1926, 1 ♂ (C. & B.); Spottswood, Oct. 4, 1926, 7 ♀, 4 ♂ (C. & B.).

North Carolina: Lake Waccamaw, Oct. 21, 1926, 6 ♀, 1 ♂ (C. & B.); Davis Gap, Waynesville, Oct. 14, 1926, 1 ♀ (C. & B.).

Wyoming: East Entrance to Yellowstone Park, Aug. 31, 1927, 2 ♀, 1 ♂ (C. R. C.).

This small species is sometimes found in very large numbers in dead leaves of deciduous trees and on at least one conifer, the cedar. The names assigned to this and its near relative *L. forcepeta* were suggested from the shape of the claspers in the male.

***Lachesilla forcepeta* new species**

Female:

Length of body 1.6 mm. ave. of 6 individuals.

Length of fore wings 1.6 mm. ave. of 6 individuals.

Length of antennæ 1.1 mm. ave. of 6 individuals.

Very similar to *contraforcepeta* in size, color and general appearance, the genitalial characters serving to distinguished the species. Subgenital plate (Pl. XVII, Fig. 2) indistinct in unstained material, but lying below it distally, an elliptical yellowish portion of the inner genital plate distinctly visible, even in teneral forms. Upon staining, the subgenital plate is found to be rather indistinct in outline but generally quadrate, the distal margin wide and convex; entire plate pilose except for the distal marginal strip and this narrows mesally. The pair of gonapophyses curved, blunt-pointed, the proximal portion narrows at point of attachment.

Male:

Length of body 1.4 mm. ave. of 6 individuals.

Length of fore wings 1.65 mm. ave. of 6 individuals.

Length of antennæ 1.4 mm. ave. of 6 individuals.

The pair of conspicuous claspers (Pl. XVIII, Fig. 1) are awl-shaped; the basal half is wide and stout and then tapers down with a slight mesal twist, straightens out and finally terminates pointing in a definite mesal direction. Lying between the claspers at their base, the hypandrium, a wide, rather short plate with a slightly concave distal margin; midway on this distal margin a pair of small, lobe-like, weakly chitinated plates. The parameres are fused to form a slender rod which ends at the distal margin of the hypandrium. The sense tubercles of paraprocts of moderate size, rather flat.

New York: Ithaca, Sept. 12, 1926, 1 ♀, Aug. 1, 1926, 1 ♀; Geneseo, Sept. 20, 1925, 1 ♀; Rockland Co., Sept. 10, 1925, 1 ♀, 1 nymph on juniper; Artists Lake, Suffolk Co., Sept. 19, 1926, 1 ♂ (Paratypes); Sea Cliff, L. I., Sept. 6, 1925, 11 ♀, 2 ♂, on dead oak leaves. Holotype (♂) Allotype and Paratypes.

Kentucky: Brooklyn Bridge, June 29, 1925, 1 ♂, beating bushes; Valley View, June 28, 1925, 1 ♀, 2 ♂, beating bushes.

North Carolina: Base of Mt. Pisgah, Buncombe Co., Oct. 13, 1926, 2 ♀ (C. & B.).

Tennessee: Mill Creek, below falls on Mt. Leconte, Oct. 10, 1926, 1 ♀ (C. & B.).

Georgia: Tiger, Oct. 18, 1926, 1 ♀, 1 ♂ (C. & B.).

Florida: The Glen, Marion Co., Mar. 6, 1927, 6 ♀, 4 ♂ (M. D. Leonard).

***Lachesilla forcepeta* var. *major* new variety**

Female:

Length of body 1.7 mm. ave. of 4 individuals.

Length of fore wings 2.0 mm. ave. of 4 individuals.

Length of antennæ 1.6 mm. ave. of 2 individuals.

Differs from *forcepeta* as follows: is larger; definite rings of grey occur on the abdomen; the wings are nearly hyaline, the veins distinct, stout. No significant point of difference was found in the genitalia.

Male:

Length of body 1.5 mm. ave. of 4 individuals.

Length of fore wings 1.8 mm. ave. of 4 individuals.

Length of antennæ 1.5 mm. ave. of 3 individuals.

The claspers (Pl. XVIII, Fig. 6) while closely resembling those in *forcepeta* differ in that the basal portion is narrower, the distal portion is longer and definitely more twisted.

Tennessee: Mill Creek, below falls on Mt. Leconte, Oct. 10, 1926, 2 ♀, 1 ♂ (C. & B.).

Virginia: Spottswood, Oct. 4, 1926, 1 ♂ (C. & B.).

North Carolina: Summit of Big Bald, Pisgah Range, Oct. 13, 1926, 1 ♀ (C. & B.); Cowee Mts., Swain Co., Oct. 15, 1926, 1 ♀ (C. & B.).

Indiana: Tremont, Sand Dunes, July 24, 1926, 2 ♂, 1 nymph, in dry oak leaves.

Florida: The Glen, Marion Co., March 6, 1927, 11 ♀ (M. D. Leonard).

***Lachesilla corona* new species**

Female:

Length of body 1.85 mm. ave. of 6 individuals.

Length of fore wings 2.0 mm. ave. of 6 individuals.

Length of antennæ 1.5 mm. ave. of 6 individuals.

Head and thorax tan, abdomen dull white ringed or not with grey. Head and appendages uniformly tan with the dotted areas of the vertex indistinct, deeper tan. Eyes dull, bluish black.

Thorax: Uniformly tan throughout, including the legs; somewhat darker on tergum with some paling on the pleuræ. Wings unmarked, the fore wings with a faint orange cast. Veins distinct, tan.

Abdomen whitish, coarsely striped or not with grey. In teneral specimens a broken dark line extends along the sides of the abdomen, thorax, and ending at the genæ. Genitalia (Pl. XVII, Fig. 4) characterized by a broad readily visible subgenital plate bearing a diamond shaped, rather weakly chitinized distal portion which bears a long, slender, straight prong. Subgenital plate cleft apically. Interior genital plate large, diamond shaped, almost completely obscured by the subgenital plate. Gonapophyses long, slender, curved, somewhat swollen at base; the dorsal margin forms a straight line when viewed from the side. Sense tubercles of paraprocts of usual size, brown and purplish. Suranal plate elongate, evenly rounded distally, the distal three-fifths more highly chitinized than basal portion.

Male:

Length of body 1.7 mm. ave. of 6 individuals.

Length of fore wings 2.1 mm. ave. of 6 individuals.

Length of antennæ 1.6 mm. ave. of 6 individuals.

Marked as female, and of much the same general appearance; eyes slightly larger and antennæ somewhat more robust. Genitalia (Pl. XVIII, Fig. 11) symmetrical, hypandrium a large plate which is divided into a pair of lateral pieces by a wide deep notch. These are united at the base where a wide narrow plate is also fused. The fused parameres are Y-shaped and strongly chitinized, each arm in turn giving rise to a long, less strongly chitinized prong. Laterally from a distal point on each element of the

hypandrium arise two pairs of long slender arms. The inner pair closely resembles the pair in *rufa*, bending strongly mesally and then twisting out laterally again. The outer pair are twisted a little at the base but are nearly straight throughout most of their length. Below and between the sense tubercles, the paraprocts are reduced mesally to form a pair of short, flat, blunt prongs.

New York: Hudson, July 15, 1926, 3 ♀ in dry leaves on fallen tree; Ithaca, Aug. 22, 1926, 2 ♀, 1 ♂ on red cedar Holotype, (♂) Allotype Paratype, June 11, 1907, 2 ♀, 3 ♂ "from round golden-rod-gall Cage"; Enfield Center, Sept. 27, 1927, 1 ♂ (Chester Rea) on wood pile (mostly willow); Penn Yan, Sept. 29, 1926, 2 ♀, 1 ♂; Wellsville, Sept. 15, 1925, 1 ♀; Sea Cliff, L. I., Sept. 6, 1925, 1 ♀ in dead oak leaves.

Virginia: Spottswood, Oct. 4, 1926, 1 ♂ (C. & B.).

This species is readily distinguished from the others by the maze of antler-like prongs in the genitalia of the male.

Lachesilla nubilis (Aaron)

Cacilius nubilis Aaron. Acad. Nat. Sci. Phila. Proc. **38**: 13.

Pl. 1, Fig. 3.

Female:

Length of body 1.6 mm. ave. of 7 individuals.

Length of fore wings 2.1 mm. ave. of 7 individuals.

Length of antennæ 1.4 mm. ave. of 4 individuals.

Head: The dotted areas of vertex tan or brown according to the individual; the lateral ocelli margined mesally with a brownish black crescent, the median ocellus with a similarly located spot; clypeus appearing entirely tan, but actually lineated with wide mesally directed tan lines with an uncolored crescent on the anterior margin; genæ tan paling anteriorly, labrum with some brown. Maxillary palpus brown, the first segment pale. Antennal segments 1 and 2 and proximal half of 3 pale, then the segments becoming tan deepening to brown distally. Eyes dull black.

Thorax: Tergal lobes golden brown, pale tan in the sutures; pleurae light brown with considerable fading to white. Legs tan, tarsi light brown. Wings hyaline, (Pl. XXI, Fig. 18) fore wings marked with brown as follows: elongate spots at end of

veins R_1 to Cu_2 , inclusive, which narrow to points at the wing margin; the distal half of the wing more or less clouded with pale brown (not visible in some specimens) with hyaline crescents or triangles at the wing margin between veins. Pterostigma opaque of the usual shape. Veins brown, distinct. Hind wings hyaline with small brown spots at end of veins.

Abdomen: Often strongly striped and generally overcast with dark purplish grey. Genitalia (Pl. XVII, Fig. 1) moderately distinct, characterized by the absence of the arm-like pair of gonapophyses. Subgenital plate broad, definitely chitinized laterally especially surrounding point of attachment. Margin beyond attachment forming a flattened letter M. Fused to the subgenital plate below, midway, a plate with a convex basal margin and with a slight cleft midway; it is composed of a pair of roughly triangular side pieces. The interior genital plate projects beyond the subgenital plate, the chitinized portion forming the letter W, the lateral parts wide, blunt pointed, the middle portion with strong laterally directed prongs which extend behind the lateral pieces; the puncture is visible just below the W-shaped part; interior genital plate broadly attached to what is probably the eighth tergite. Sense tubercle of paraprocts rather large, brown.

Male:

Length of body 1.4 mm. ave. of 4 individuals.

Length of fore wings 2.2 mm. ave. of 4 individuals.

Length of antennæ 1.5 mm. measurement of 1 individual.

Generally identical with female in markings; eyes twice as large; markings on wings probably not as distinct or extensive. Genitalia and terminal abdominal segments (Pl. XVIII, Fig. 5) symmetrical, occupying nearly a third of the abdomen. Strongly chitinized, pincer-like projections extend mesally from the eighth segment and from the longer basal prongs arise a pair of long sword-shaped laterally directed claspers which are drawn out to a fine point distally and are slender proximally. Between the pincer-shaped pieces a small plate (hypandrium?) with slightly convex margins on all sides, the distal margin only half as wide as the basal one. The parameres consist of a long, stout rod,

furcated at the base, somewhat belled out distally, but arising directly from the belled out cavity a highly chitinized Y-shaped structure. This forms the basal support for a pair of long, narrow, twisted plates below which in turn lies a pair of curved, slender arms which are not readily visible unless viewed laterally. Covering the Y-shaped support, a small plate with a concave distal margin except for a peak midway, while the basal margin is convex and the lateral margins with a notch near base. Sense tubercles brown, of moderate size, arising between them a pair of small, blunt, highly chitinized prongs. On the suranal plate a weakly chitinized structure which when viewed in profile consists of a pair of ear-like lateral lobes separated by a straight median portion.

Texas: "Southern Texas, one specimen discovered while beating a live oak thicket" (Aaron) P. A. N. S. Holotype.

Oklahoma: Comanche Co. 6 ♀ 4 ♂ (T. H. Hubbell).

Tennessee: Bristol, Oct. 5, 1926, 1 ♀ (C. & B.) taken at light of Coca-cola stand; Summit of Mt. Leconte, Oct. 10, 1926, 1 ♀ 1 ♂ (C. & B.).

North Carolina: Frying Pan Gap, Mt. Pisgah, Oct. 13, 1926, 1 ♀ (C. & B.).

Florida: Orlando, Jan., 2 ♂ (O. C. McBride).

An examination of the types of *Cacilius nubilis* Aaron showed the absence of hairs on the wing which places the species in *Lachesilla*. *L. nubilis* and *punctata* appear to be closely related as indicated by the genitalia and wing markings.

***Lachesilla pacifica* new species**

Female:

Length of body 1.5 mm. ave. of 4 individuals.

Length of fore wings 1.7 mm. ave. of 4 individuals.

White, marked with brown and purplish grey.

Head: The dotted areas on vertex distinct; clypeus lineated with faint brown with an unmarked crescent on the anterior margin; genæ and labrum white with a faint brown streak on genæ. Maxillary palpus brown. Eyes dull black.

Thorax brown above on tergal lobes, paling at sutures; coxæ and dorsal half of pleuræ brown, ventral half pale. Legs pale, tarsi somewhat darker. Wings unmarked, subhyaline. Veins brown, distinct. Pterostigma opaque, of moderate depth.

Abdomen with a purplish grey cast on the sides; sometimes assuming form of stripes. Subgenital plate (Pl. XVII, Fig. 5) readily visible, five-sided with a blunt, slightly concave apex. Lying below the subgenital plate at its apex a rather strongly chitinized small plate with a triangular cleft at its base. Gonapophyses blunt-pointed, broadly attached; somewhat constricted just beyond attachment; the piece is bent to face mesally. Sense tubercles of paraprocts small, purplish. Suranal plate roughly heart-shaped.

Washington: Seattle, Aug. 7, 1927, 5 ♀ (C. R. C.) Holotype and Paratypes.

Lachesilla pedicularia Linne

A nearly complete synonymy of this species appears in Enderlein, G. Catt. Coll. Selys Longchamps Fasc. 3 Part 3: 16-19. 1915.

Female (*macropterous*):

Length of body 1.55 mm. ave. of 10 individuals.

Length of fore wings 1.7 mm. ave. of 10 individuals.

Length of antennæ 1.3 mm. ave. of 10 individuals.

This cosmopolitan species shows considerable variation in size, intensity and extent of coloration.

Typically the head, thorax, their appendages and the terminal abdominal segments and genitalia golden brown, abdomen dull white, ringed with distinct greyish brown stripes which are usually confined to the tergites.

Head: Uniformly shining golden brown ranging to a very deep brown; paling at genae and labrum. Eyes small, dull black.

Thorax: Uniformly golden brown ranging to dark brown, with some paling on pleuræ. Legs light brown throughout. Wings (Pl. XXI, Fig. 17) hyaline, iridescent. Pterostigma opaque, of usual shape. Veins distinct, brown.

Abdomen dull white, usually distinctly striped with greyish brown. In some individuals the stripes narrow, or almost lacking, while on the other extreme they may be broad, almost touching each other, and dark purplish brown in color; a rather characteristic indication of a mid-dorsal line. Genitalia (Pl. XVII, Fig. 11) relatively strongly chitinized, making the parts readily visible. The subgenital plate wide, with a median notch

basally; the distal margin convex, even slightly blunt-pointed. The puncture on the interior genital plate is made visible by a wide border of chitinization. Gonapophyses of moderate proportions, blunt pointed, directed mostly mesally; rather wide for a short distance proximally. Sense tubercles of paraprocts brown, inconspicuous. Suranal plate short, wide, blunt pointed.

Female (*brachypterous*):

Length of body 1.7 mm. ave. of 10 individuals.

Length of fore wings .9 mm. ave. of 10 individuals.

Length of antennæ 1.25 mm. ave. of 10 individuals.

Short-winged females (Pl. XXI, Fig. 10) are commonly found where the species breeds. Wings reduced in all directions; veins distinct in both pairs of wings and retaining all the venational characters of the genus. *Brachypterous* females are probably not capable of flight; in my collections they have been taken exclusively where the species breeds. The abdomen is probably more plump on the average than *macropterous* females.

Male:

Length of body 1.35 mm. ave. of 10 individuals.

Length of fore wings 1.65 mm. ave. of 10 individuals.

Length of antennæ 1.55 mm. ave. of 10 individuals.

(Individuals with wings only 1.1 mm. long have been found but 1.65 mm. is a fair average length for normal males.)

Resembles female, less robust; antennæ more robust, eyes small, of same size as female. The genitalia distinct, brown, concolorous with head and thorax. Markings on abdomen probably not as extensive or intensive as female.

Genitalia (Pl. XVIII, Fig. 2) symmetrical consisting of a wide short plate composed of two parts: a basal portion or hypandrium triangular in outline, the base of the triangle being the wide nearly straight basal margin of the compound piece—a slight ridge occurs midway; the distal part consists of a pair of claspers, the basal portions of which are nearly fused to the hypandrium. Running diagonally at this point a pair of highly chitinized strips which distally nearly meet and there twist laterally giving rise to sharp, caudally pointing prongs. The fused parameres Y-shaped. Basal portion stout extending be-

hind the hypandrium; the branches long, very slender and drawn out to fine points. The sense tubercles rather larger than usual, paraprocts giving rise to small, ventro-mesally directed plates. Distally on suranal plate arises a small ventrally pointing hook while just cephalic of its base a small puncture.

New York: Ithaca, Oct. 3, 1925, 1 ♀ (T. C. Barnes) sweeping grass, Sept. 10, 1925, 2 ♀ 2 ♂ (P. P. Babiy), Aug. 13, 1926, 1 ♀ (P. P. Babiy), Sept. 5, 1926, 1 ♂ (P. P. Babiy) Aug. 30, 1924, 1 ♂ indoors, Sept. 23, 1926, 1 ♂ (K. C. Sullivan) floating dead in Beebe Lake; Hadley, Aug. 15, 1925, 1 ♂ (T. C. Barnes) in box containing white pine shoots; Enfield Center, Sept. 27, 1927, 35 ♀ (10 *brachypterous*) 22 ♂ (Chester Rea) breeding under loose bark on wood (mostly willow) in woodpile; McLean Reservation, Argus Brook, Sept. 16, 1924, 1 ♂ (Sibley); Moravia, Sept. 3, 1922, 1 ♀ 7 ♂ (T. Helen MacLean); Rock City, Sept. 16, 1925, 1 ♂ in dead leaves; Montour Falls, Sept. 21, 1924, 1 ♂; Richburg, Sept. 16, 1925, 1 ♀ 2 ♂ in dead leaves; West Barre, Sept. 19, 1925, 3 ♀ in dead leaves; Stow, Sept. 17, 1925, 1 ♂ in a dead leaf; Painted Post, Sept. 15, 1925, 1 ♂ in a dead leaf; Penn Yan, July 5, 1926, 1 ♂ (C. R. C.); Upper Red Hook, Aug. 28, 1925, 1 ♀ 1 ♂ on barn wall; Nigger Pond, Oswego Co., Sept. 3, 1926, 1 ♂; Lake George, Sept. 15, 1925, 1 ♂ (M. D. Leonard); Whetstone Gulf, Lewis Co., Sept. 2, 1926, 1 ♂ in dead leaves; Medina, Sept. 16, 1927, 4 ♀ 1 ♂ (M. D. Leonard) occurring in large numbers on corn.

Maine: Seabasticook Lake, Aug. 26, 1925, 20 ♀ 1 ♂ (C. R. C.) in damp hay.

Vermont: Woodstock, Sept. 1925, 5 ♂ (A. M. Nadler) in barn.

Pennsylvania: Arendtsville, Aug. 23, 1922, 1 ♂ (S. W. Frost) taken from the stomach of the frog *Hyla pickerinii* Holbrook.

Kentucky: Quicksand, June 25, 1925, 24 ♀ (12 *brachypterous*) 29 ♂ and 11 nymphs. Breeding in large numbers in moist straw and débris in old houses; Quicksand, June 25, 1925, 31 ♀ 18 ♂ large numbers stuck in paint on house.

North Carolina: Jacksonville, Oct. 23, 1926, 1 ♀ (C. & B.); Mt. Pisgah, Oct. 14, 1926, 1 ♀ (C. & B.).

Utah: Logan, July 3, 1926, 1 ♀ (J. G. Needham).

Washington: Longmire, Aug. 22, 1927, 1 ♂ (C. R. C.).

Among the winged members of the Corrodentia, *L. pedicularia* is probably the most numerically common and widespread. It is found in most of the inhabited portions of the world. It breeds indoors and out, occurring in a great variety of situations. At times great swarms appear which rival the flights of migrating aphids. I have seen newly painted houses entrap thousands of this psocid. *L. pedicularia* not infrequently appears in Economic literature. It is occasionally an important household pest, breeding in furniture and mattresses stuffed with plant parts and where it usually is associated with *Trogium pulsatorium* L. and *Liposcelis divinatorius* Müll.

The rather unusual variation in size markings and presence of specialized forms has led to the creation of many synonyms.

Lachesilla punctata (Banks)

Elipsocus punctatus Banks. Am. Ent. Soc. Trans. 32: 1. 1905.

Female:

Length of body 2.2 mm.

Length of fore wings 2.4 mm.

Length of antennæ 1.6 mm.

Head: Dotted areas of vertex brown; clypeus dull orange, lineated with darker orange the lines directed mesally; labrum brown; genæ whitish with a small white spot below the eye. Eyes a phosphorescent greenish blue. Antennæ brown, dark distally, pale proximally. Maxillary palpus brown, each segment becoming progressively darker distally.

Thorax: Generally brown with several whitish areas on dorsum. Legs pale, tarsi and distal portion of tibiae brown. Wings hyaline, with brown spots at the end of veins R_{2+3} to M_3 inclusive. The spots are roughly heart-shaped. Veins dark brown margined with brown distally, pale proximally. Hind wing hyaline, with a faint brown spot at end of viens.

Abdomen dull whitish, broad and coarsely ringed with brownish grey. Terminal abdominal segments and genitalia (Pl. XVII, Fig. 12) distinctly chitinized. Subgenital plate large, somewhat hexagonal in form and distally superimposes a plate

the basal margin of which is strongly chitinized. These two plates fuse distally to form long lateral lobes between which lies a membranous quadrate piece. Lying just below these terminal pieces the distally chitinized roughly hexagonal interior genital plate with the basal side deeply cleft and the four distal angles produced into sharp prongs; the puncture lies in the distal two-fifths. Gonapophyses degenerated into insignificant, slender arms, the oval distal portion only being distinctly visible. Sense tubercles on paraprocts dark purple. Suranal plate elongate, lobe-like.

Male:

Length of wings 3.0 mm.

Similar in markings to female.

Genitalia (Pl. XVIII, Fig. 8) symmetrical. Arising at termination of narrow pincher-shaped projections, a pair of extremely long and slender sickle-shaped claspers. The ninth segment completely bridged ventrally by an elaborated U-shaped part. The fused parameres consist of a long slender rod which forks distally, each fork terminating in a foot-like enlargement. The distal two-fifths of parameres covered by a small heart-shaped hypandrium. Sense tubercles of paraprocts small, bearing mesally a short, straight, upward pointed prong. Suranal plate produced into a single very large beak-shaped piece, broad at base and apex pointed ventrally.

California: San Mateo Co. 7 specimens (Baker) Holotype (♂) Allotype, Paratypes. M. C. Z.

Arizona: Prescott, Aug. 23, 1927, 1 ♀ at light (J. D. Hood).

This species was originally placed in *Elipsocus* by Banks but an examination of type material revealed that it should be assigned to *Lachesilla*. The female used here may not be *punctata*. It was only possible to examine critically the one female from Prescott, Arizona, which superficially was similar to the male paratype studied but the wing measures .5 mm. shorter.

Lachesilla rufa (Walsh)

P(socus) rufus Walsh. Ent. Soc. Phila. Proc. **2**: 185. 1863.

Cæcilius rufus Hagen. Verh. zool.-bot. Ges. Wein. **16**: 206. 1866.

Pterodela rufa Enderlein. Stett. Ent. Zeit. **67**: 319. 1906.

Cæcilius impactus Aaron. Acad. Nat. Sci. Phila. Proc. **38**: 14. 1886.

Female:

Length of body 2.3 mm. ave. of 7 individuals.

Length of fore wings 2.7 mm. ave. of 7 individuals.

Length of antennæ 2.0 mm. ave. of 7 individuals.

Head: Dotted areas of vertex tan, moderately distinct; clypeus dull orange due to the indistinct lineation of broad, broken, mesally directed lines; labrum pale orange; genæ white obscurely touched with tan. Maxillary palpus light brown, last segment darkest. Antennæ pale in proximal segments darkening to brown distally. Eyes dull bluish black.

Thorax: Tan with considerable fading to pale orange or white both on the tergal lobes and on the pleuræ. Legs pale, tarsi light brown. Wings (Pl. XXI, Fig. 16) unmarked, hyaline with possibly a faint orange tint. Veins slender, pale brown; M, Rs and branches darker. In some specimens Rs joined to M at point. Veins in hind wings pale.

Abdomen: White, coarsely ringed with grey, venter pale. In the genitalia (Pl. XVII, Fig. 9) the interior genital plate hexagonal in outline and strongly chitinized, being readily visible even in teneral forms. The subgenital plate rather weakly chitinized except laterally. Midway distally is borne a small forked plate of which the forked portion occupies the distal half of the process. (This plate not readily seen in unstained material.) The gonapophyses large, straight, rather broadly attached, tapering down gradually to the apex. The puncture on the interior genital plate lies about midway and it is framed by a chitinized yoke. Sense tubercles of paraprocts rather small, dark purple. Suranal plate elongate, evenly rounded distally.

Male:

Length of body 1.9 mm. ave. of 7 individuals.

Length of fore wings 2.75 mm. ave. of 7 individuals.

Length of antennæ 2.45 mm. ave. of 7 individuals.

Closely resembles female in markings. The antennæ more robust, but the eyes are not appreciably larger. Abdomen shorter and much less robust than female, truncate distally.

Genitalia (Pl. XVIII, Fig. 3) symmetrical. The hypandrium very large, slightly more highly chitinized in the basal three-fifths, the distal margin concave with a narrow, strongly chitinized margin. At the base of the hypandrium a small narrow plate. A pair of conspicuous curved claspers arise laterally of the hypandrium, lying along its lateral margin curving strongly mesally and then dorsally and laterally. The parameres fused, Y-shaped, consisting of a short base and extremely long and slender arms. Sense tubercles of paraprocts of usual size while below and between these a pair of short, straight, dorsally directed prongs.

New York: Ithaca, Sept. 12, 1925, 1 ♀ 1 ♂ in dead oak and poplar leaves; Penn Yan, Sept. 29, 1926, 4 ♀, Aug. 2, 1925, 1 ♀; Richburg, Sept. 16, 1926, 12 ♀ 1 ♂ in dry leaves; Rock City, Sept., 1925, 6 ♀ in dead leaves; West Barre, Sept. 19, 1925, 2 ♂ in dead leaves; Barcelona, Sept. 19, 1925, 11 ♀ 3 ♂ in dead leaves; Silver Creek, Sept. 18, 1926, 6 ♀ 5 ♂ in dead leaves; Geneseo, Sept. 20, 1925, 8 ♀ in dead leaves and on dead cedar branches; Elmira, Oct. 1, 1925, 8 ♀ 8 ♂ in dead oak and chestnut leaves; Stow, Sept. 17, 1925, 7 ♀ 5 ♂ in dead leaves; Rochester, Oct. 8, 1927, 6 ♀ 2 ♂ (J. D. Hood) beating miscellaneous trees.

Indiana: Tremont, July 24, 1926, 1 ♀ in dry oak leaves. Sand Dunes.

Virginia: Blacksburg, Oct. 4, 1926, 3 ♀ 1 ♂ (C. & B.).

North Carolina: Andrews, Oct. 17, 1926, 1 ♂ (C. & B.); Summit of Big Bald, Pisgah Range, Oct. 13, 1926, 1 ♂ (C. & B.); Mt. Pisgah, Oct. 14, 1926, 1 ♀ (C. & B.); Wayah Bald, Macon Co., Oct. 16, 1926, 1 ♂ (C. & B.); Base of Mt. Pisgah, Buncombe Co., Oct. 13, 1926, 2 ♀ (C. & B.).

Tennessee: Mill Creek, below falls on Mt. Leconte, Oct. 10, 1926, 2 ♂ (C. & B.); Laurel Creek, Sevier Co., Oct. 8, 1926, 21 ♀ 2 ♂ (C. & B.); Bristol, Oct. 5, 1926, 1 ♂ (C. & B.) taken at light of Coca-cola stand; Summit of Mt. Leconte, Oct. 10, 1926, 2 ♀ (C. & B.).

Georgia: Tiger, Oct. 18, 1926, 1 ♀ (C. & B.); Top of Blue Ridge at Towns and Rabun Co. line, Oct. 18, 1926, 1 ♀ (C. & B.).

Pennsylvania: Philadelphia, 1 ♂ (Aaron) Holotype of *Cæcilius impactus*. P. A. N. S.

The type of *rufa* is non-existent. In Walsh's description he indicates that the species measures 3.25 mm. "length to tip of wings." This relatively large size, together with Walsh's short description is sufficient to identify the species. *L. rufa* is exceedingly common in the dead or dying leaves of deciduous trees. Aaron's *Cæcilius impactus* is a male of *L. rufa*.

Lachesilla silvicola new species

Female:

Length of body 1.8 mm. ave. of 7 individuals.

Length of fore wings 2.15 mm. ave. of 7 individuals.

Length of antennæ 1.4 mm. ave. of 5 individuals.

Head: Dotted areas of vertex light brown; a small brownish area on front touching the median ocellus; a brown ring around antennal socket, extending from which a short brown line touching eye midway and a longer parallel line below eye; clypeus with a large triangular white area posteriorly and a crescent-shaped paling along anterior margin. The remaining lateral areas lineated with broad tan; genæ, except for line below eye, dull white; labrum unmarked. Maxillary palpus pale, last segment light brown. Eyes dull bluish black. Antennæ pale at base, light brown distally.

Thorax: Mostly dull white above, tergal lobes white margined with pale brown; pleuræ brown at, and bordering sutures, a longitudinal broken brown line midway (especially noticeable on teneral forms). Legs pale, tarsi golden brown. Wings (Pl. XXI, Fig. 9) unmarked, hyaline. Pterostigma opaque, of usual shape. Veins pale throughout, becoming light brown distally. M and Cu typically united at a point.

Abdomen: Dull white above with stripes of greyish brown on the sides, fading caudally. (The abdomen of specimens at hand covered with white patches. The specimens were collected into 95% alcohol, which may be responsible for the condition.) Genitalia (Pl. XVII, Fig. 3) not readily visible in unstained material. On the subgenital plate, arising midway, a small forked plate similar to the structure in *arida* and *rufa*—short and wide as in *arida*. Upon staining, the subgenital plate is found to be rather indefinite in outline, the distal margin wide and convex; cephalic to the forked plate, the subgenital plate pilose, while the large distal elliptical area non-pilose. Interior genital plate diamond-shaped with a highly chitinized turned under flap basally and an infuscated area apically and around the puncture. Gonapophyses short, blunt-pointed, and with a swollen basal portion at attachment to plate. This plate is fused with the distal

portion of the interior genital plate and extends considerably caudo-laterally of the gonapophyses. Sense tubercles of paraprocts small, brown.

Male:

Length of body 1.5 mm.

Length of fore wings 2.4 mm.

Markings as in female; more slender throughout; eyes not appreciably larger. Genitalia (Pl. XVIII, Fig. 12) asymmetrical. Hypandrium a large roughly rectangular plate which has a deep crescent-shaped, less highly chitinized part distally. Fused to this plate midway—and outside—a pair of lateral strips and a long median strip giving rise to a large clasper with a spear-shaped apical portion. (In the single specimen available the point turns to the left.) The parameres lying just below the spear-shaped apex independent, each element being stout, blunt-pointed, upward directed prongs. Laterally beyond the median plate a pair of small lobe-like plates (the claspers of other members of the genus?) with a sense field proximally. Dorsally a pair of asymmetrical twisted prongs which arise mesally from small swollen areas; dorsally of these the suranal plate, a small, highly chitinized, convex, elongate plate, rounded distally and constricted proximally.

Washington: Seattle, Aug. 7, 1927, 4 ♀ 1 ♂ (C. R. C.) Holotype (♂); Allotype, Paratypes. Longmire, Aug. 22, 1927, 63 ♀ (C. R. C). Paratypes; Edmonds, Aug. 16, 1927, 13 ♀ (C. R. C.). Paratypes.

Subfamily Bertkauiniæ

Bertkauia Kolbe 1882

Type: *B. lucifuga* Rambur 1882.

Female apterous (male unknown to me). Segments of thorax nearly uniform in size. Legs unarmed by ctenidia, tarsi two segmented, segments long. Head elongate, narrow, (especially between the eyes) clypeus convex but relatively flat. Ocelli absent. Antennæ thirteen-jointed. Buccal rods stout, very prominent; distally they are flattened and so twisted that the flattened surface faces dorso-mesally; the distal margin is strongly chitinized and produced into eight or more short teeth which from their disposition would suggest a saw-like function. Abdomen very large. In genital processes (Pl. XIX, Fig. 9) an indication of three pairs of gonapophyses. Lateral surface of paraprocts flat, triangular and without sense tubercles.

***Bertkaulia lepididinaria* new species**

Female:

Length of body 3.0 mm. ave. of 10 individuals.

Length of antennæ 3.0 mm. ave. of 10 individuals.

Head: Vertex orange suffused with brown which deepens anteriorly, a large median U-shaped mark of pure orange; remainder of head dark brown with the genæ palest except for a dark spot anteriorly. An elongate fuscous spot ahead of eye, which extends slightly beyond the base of antennæ (not distinguishable in deeply colored specimens). A deep pit below antennæ. Antennæ dark brown, sparsely clothed with long hair, the first segment distally with a shield-shaped membranous area. Maxillary palpus long, slender, dark brown throughout. Eyes small, dull bluish black.

Thorax dull white above; medianly on tergum of prothorax a pair of conspicuous hairs while the tergum of meso- and metathorax sparsely pilose. Pleuræ dark brown and likewise the legs; tarsal claws long, slender, with a long inner proximal spine.

Abdomen dull yellowish white marked with brown suffused with grey. The pigment is typically distributed as follows: venter pale; on the sides a large, irregular spot or stripe which is distinct cephalically and narrows or fades out caudally; stripes extending dorsally from this spot at the sutures (they usually fade out well before the dorso-median line); above medianly, elongate, diamond-shaped marks centering on the suture between segments 1 and 2, 2 and 3, while on segments 5 and 6 two long, broad bands which narrow down to a triangular mark on 7 and a line on 8. Abdomen strongly pilose, the hairs roughly arranged in two rows to a segment; hairs on dorsum several times longer than those on venter.

Genital processes (Pl. XIX, Fig. 8) brown. The subgenital plate V-shaped with a blunt pointed apex. Gonapophyses consisting of two distinct pairs (Pl. XIX, Fig. 9). The ventral gonapophyses long, slender blades which gradually widen distally and are then suddenly produced into a sharp drawn out point. The other pair of gonapophyses consist of two parts, the proximal portion probably representing the lateral gonapophyses and the distal piece the dorsal gonapophyses. The basal portion is broad, elongate, convex and bears a staggered row of from 5 to 7 (possibly more or less) spines along the lateral margin; the distal part is twisted mesally at right angles (attached to the basal part by a slender neck) and consists of a broad, hook-like basal portion and an extremely long and finely drawn out distal portion. Paraprocts triangular, pilose on distal half and especially along this margin. Suranal plate dull orange, nearly semicircular in form, pilose.

New York: Ithaca, 1926 collections: Aug. 6, 15 ♀, Aug. 15, 7 ♀, Aug. 22, 11 ♀, Sept. 26, 7 ♀ 3 nymphs. On large stones in shade. Holotype and Paratypes. Penn Yan, Aug. 29, 1926, 34 ♀ 3 nymphs on large stones in shade; Michigan Mills, Lewis

Co., Sept. 1, 1926, 24 ♀ on stones in stone wall; Hunter, Aug. 16, 1925, 11 ♀ 1 nymph on stones; Penn Yan, Aug. 2, 1925, 11 ♀ 5 nymphs on large stones.

Kentucky: Lexington, July 5, 1925, 2 ♀ (L. Giovannoli).

***Bertkaulia crosbyana* new species**

Female:

Length of body 2.3 mm. ave. of 10 individuals.

Length of antennæ 2.15 mm. ave. of 10 individuals.

Similar to *lepididinaria*, differing from it principally in size, markings (mostly abdominal) and habitat. This species averages fully .5 mm. shorter. It is almost invariably found in leaf mold while its relative appears to be confined almost exclusively to stones. The genitalia are so similar as to appear identical.

In most specimens of *Bertkaulia crosbyana* there is a distinct contrast between the almost uniform creamy white or violet of the abdomen and the dark brown of head, thorax, genitalia, and the appendages. Neither the broad brown bands on the fifth and sixth tergites nor the clear-cut markings on segments 1-3, appearing in *lepididinaria*, are found on *crosbyana*. In darker individuals a greyish violet spot lies anteriorly on the sides of the abdomen; these spots may widen, fuse and continue across the dorsum at segments 1-3. In still other individuals all the tergites are uniformly greyish violet. No dark spots by the antennæ and on genæ appear in *crosbyana*; the head is frequently almost uniform brown with little or no trace of orange on the vertex.

New York: Ithaca Aug. 1, 1926, 2 ♀ 1 nymph, Sept. 26, 1926, 1 ♀, July 12, 1925, 34 ♀ 8 nymphs in leaf mold, Aug. 1, 1926, 2 ♀ 1 nymph. Holotype Paratypes. McLean, July 31, 1926, 2 ♀ 1 nymph under stones; Penn Yan, Aug. 29, 1926, 1 ♀; Michigan Mills, Lewis Co., Sept. 1, 1926, 6 ♀; Wading River, L. I., Sept. 19, 1926, 10 ♀ 11 nymphs (A. M. Boyce) sifting leaves; Baiting Hollow, Suffolk Co., Sept. 19, 1926, 1 ♀ (A. M. Boyce); Hunter, Aug. 16, 1925, 5 ♀; Penn Yan, Aug. 2, 1925, 8 ♀ 1 nymph; Sea Cliff, L. I., Sept. 5, 1925, 18 ♀ (Augusta Wolf) sifting leaves; Ringwood, Tompkins Co., July 13, 1925, 2 nymphs, sifting leaves; Olcott, Sept. 19, 1925, 1 ♀ (C. R. C.); Wawbeek, July 26, 1925, 2 nymphs (C. R. C.) sifting leaves; Hague, Sept. 16, 1925, 1 ♀ (M. D. Leonard); Stow, Sept. 17, 1925, 8 ♀ 1 nymph (C. R. C.); Tuxedo, Oct. 7, 1925, 4 ♀ (Augusta Wolf) sifting leaves; Enfield Glen, Aug. 23, 1925, 4 ♀ (Augusta Wolf) sifting leaves; Larchmont, Sept. 25, 1925, 1 ♀

(Augusta Wolf); Rock City, Sept. 16, 1925, 2 ♀ (C. R. C.) sifting leaves; Painted Post, Sept. 15, 1925, 1 ♀ (C. R. C.) sifting leaves; Potter, July 16, 1926, 7 ♀ 1 nymph (C. R. C.) sifting leaves; Whetstone Gulf, Lewis Co., Sept. 2, 1926, 5 ♀ (C. R. C.); Mt. McIntyre, Essex Co., July 24, 1925, 8 nymphs (C. R. C.) sifting leaves; Adirondack Lodge, Essex Co., July 23, 1925, 2 ♀ 1 nymph (C. & B.).

Maine: Island Falls, Aug. 16, 1925, 1 ♀ (C. R. C.); Molunkus Pond, Aug. 25, 1925, 3 ♀ (C. R. C.).

New Hampshire: Littleton, Aug. 19, 1925, 1 ♀ (C. R. C.); Base Station, Mt. Washington, Aug. 18, 1925, 6 ♀ 1 nymph (C. R. C.).

Minnesota: Lake Minnetonka, Sept., 1925, 7 ♀ 3 nymphs (F. C. Fletcher).

Illinois: Belleville, Aug. 12, 1 ♀ (C. R. C.).

Kentucky: Quicksand, June 25, 1925, 11 ♀ 1 nymph (C. R. C.) sifting leaves.

South Carolina: Sumter, Oct. 20, 1926, 2 ♀ 6 nymphs (C. R. C.).

Florida: Dunedin, Dec. 15–Jan. 8, 1925–26, 1 ♀ (W. S. Blatchley); Micanopy, March 6, 1927, 1 ♀ (T. H. Hubbell).

Mississippi: Oxford, Sept., 1905, 1 ♀

Subfamily Peripsocinae

Peripsocus Hagen 1866

Type: *P. phæopteros* Stephens 1836.

In *Peripsocus*, Cu is unbranched and in the hind wing M is fused to Cu for a variable distance; the veins and wing margins are unhaired. The genitalia of the female resemble *Psocus*. A definite ovipositor is present consisting of a distinct egg-guide, concave dorsal gonapophyses, slender ventral gonapophyses and ear-like lateral gonapophyses. The male genitalia are symmetrical resembling in form other Cæciliidae rather than *Psocus*. Paraprocts small, not produced into claspers. Parameres very large and highly chitinized; suspended between them a complex structure which may be a true penis.

KEY TO PERIPSOCUS

- 1—Length of fore wings about 1.4 mm. (body 1.5 mm.)...*stagnivagus* n. sp.
 —Length of fore wings about 2.5 mm. or more (body 2.1 mm.).....2
 2—Vertex with a conspicuous pair of fuscous spots in addition to usual dotted areas. Genæ also with fuscous spot.....*madidus*
 —Not so marked.....3
 3—Fore wings uniformly deep fumose.....*fumosus*
 —Fore wings marked with hyaline, greyish brown and dark brown.....4
 4—Fore wings with three hyaline or subhyaline bands.....*quadrifasciatus*
 —Fore wings spotted, little or no indications of bands.....*madescens*.

Peripsocus fumosus Banks

Peripsocus fumosus Banks. N. Y. Ent. Soc. Jour. **11**: 237. 1903.

This Colorado species has uniformly brown wings, a character which is sufficient to separate it from the known members of this genus. The head of the female holotype is brown with a pair of faint darker spots behind ocelli and with faint mesally directed lines on the clypeus.

Colorado: "S. W. Colo." 1 ♀ (Oslar) M. C. Z. Holotype.

Peripsocus madescens (Walsh)

P(socu)s madescens Walsh. Ent. Soc. Phila. Proc. **2**: 186. 1863.

Peripsocus madescens Hagen. Verh. zool.-bot. Ges. Wein. **16**: 210. 1866.

Female:

Length of body 2.1 mm. ave. of 10 individuals.

Length of fore wings 2.5 mm. ave. of 10 individuals.

Length of antennæ 1.45 mm. ave. of 10 individuals.

Similar to *P. quadrifasciatus* in markings and in general appearance, more intensely colored throughout. Wings (Pl. XXI, Fig. 2) bear a characteristic pattern of irregular areas of hyaline, greyish brown, and dark brown; there are no definite bands. In general two dark brown irregular spots are found in the larger cells while in the smaller ones (pterostigma, R₃, M₁, and M₂) a single spot. Two or more hyaline spots are found in each cell. These spots vary in size and shape, and to some extent, in distribution, with each specimen. The greyish brown

borders the veins and covers those portions of the wings not mentioned. Veins distinct, dark brown. Hind wing uniformly pale greyish brown.

Abdomen whitish or frequently marked coarsely and profusely with grey or purplish grey. Genitalia brown (Pl. XIX, Fig. 1). The subgenital plate is an inverted V in shape and is composed of two parts; the basal portion consists of the pair of rather wide lateral plates which are united distally and there delimited by a wide, concave margin. The distal portion or egg-guide is short, constricted proximally, then gradually narrows to a blunt pointed apex; a pair of strongly chitinized strips extend about halfway along the lateral margin and a larger and slightly longer part extends cephalad (where they are visible below each lateral plate of the subgenital plate). The lateral gonapophyses very small, pilose and lobe-like. The projection from the rod between the lateral and dorsal gonapophyses long, slender—a flattened L in shape. Suranal plate almost equilateral triangular in shape, with a small non-chitinized triangle proximally.

New York: Ithaca, July 11, 1926, 3 ♀, Aug. 6, 1926, 1 ♀, Aug. 24, 1924, 4 ♀, Sept. 6, 1926, 4 ♀, Sept. 12, 1926, 1 ♀, Sept. 26, 1926, 1 ♀; Woodwardia Swamp, Tompkins Co., Aug. 10, 1924, 5 ♀; McLean Reservation, July 16, 1924, 1 ♀; Enfield Center, Sept. 30, 1927, 2 ♀ (Chester Rea) on willow woodpile; Little Valley, Sept. 17, 1926, 1 ♀; Penn Yan, Aug. 2, 1925, 2 ♀; Wells-ville, Sept. 15, 1925, 1 ♀; Howard, July 5, 1924, 3 ♀; Richburg, Sept. 16, 1925, 1 ♀; Cinnamon Lake, Schuyler Co., July 4, 12, 1924, 5 ♀; Hunter, Aug. 16, 1925, 5 ♀ miscellaneous beating; Ballston Lake, July 14, 1926, 1 ♀; Fairhaven, Sept. 7, 1924, 1 ♀; Michigan Mills, Lewis Co., Sept. 1, 1926, 27 ♀ beating, mostly spruce; Parkers, Lewis Co., Sept. 2, 1926, 7 ♀; Paul Smiths, Aug. 31, 1927, 43 ♀ beating, mostly larch and spruce; Nigger Pond, Oswego Co., Sept. 3, 1926, 4 ♀ on larch; Whetstone Gulf, Lewis Co., Sept. 2, 1926, 11 ♀ on dead hemlock; Adirondack Lodge, Essex Co., Sept. 2, 1927, 4 ♀.

Maine: Houlton, Aug. 26, 1925, 1 ♀ (C. R. C.).

Illinois: Belleville, Aug. 12, 1926, 1 ♀ (C. R. C.).

North Carolina: Blowing Rock, Oct. 10, 1923, 1 ♀ (C. & B.).

Georgia: Tiger, Oct. 18, 1926, 1 ♀ (C. & B.).

Florida: The Glen, Marion Co., Mar. 6, 1927, 8 ♀ (M. D. Leonard); Micanopy, Mar. 6, 1927, 1 ♀ (Borrows).

The description given by Walsh of *madescens* is sufficient to distinguish the species; the types are non-existent. *Madescens* is commonly found on dead or partially dead spruce, balsam, hemlock and larch but is occasionally found on other trees. The male is unknown to me. *P. alboguttatus* Dalman of Europe is closely related, or possibly identical with *madescens*.

Peripsocus madidus Hagen

Psocus madidus Hagen. Syn. Neuropt. of N. America, p. 12, 1861. (*Partim*).

P(socu)s permadidus Walsh. Ent. Soc. Phila. Proc. 2: 185. 1863.

Peripsocus madidus Hagen. Verh. zool.-bot. Ges. Wein. 16: 210. 1866.

Peripsocus permadidus Banks. Cat. Neuropt. Ins. p. 8, 1907.

Female (*macropterous*):

Length of body 2.35 mm. ave. of 21 individuals.

Length of fore wings 2.55 mm. ave. of 10 individuals.

Length of antennæ 2.65 mm. ave. of 21 individuals.

Readily distinguished by the presence of a pair of dark fuscous spots on the vertex and by the single shade of pale greyish brown clouding the wings. (Pl. XXI, Fig. 4).

Head: In addition to the pair of dark spots on the vertex, the ocelli are completely covered by a large dark brown or black spot; the dotted areas on vertex indistinct; normally there is a small fuscous spot anteriorly on genæ; clypeus as in the other species, lineated with golden brown, in some individuals an area bordering the lateral margins, darker; labrum dark brown or black. Eyes small, dull bluish black.

Thorax: Tergal lobes shining dark brown or black, the median lobe less intensely colored; legs pale, tibia and tarsi light brown. Fore wing clouded with a single shade of pale greyish brown whereas in *quadrifasciatus* and *madescens* two shades are present. Two illy defined hyaline bands are distinguishable: a

rather broad one across the middle of the wing involving the basal half of the pterostigma; a narrower one dividing the basal half of the wing. Veins stout, light brown. Hind wings nearly hyaline with the veins faintly margined with pale greyish brown.

Abdomen white, banded with coarse, broad, broken lines of grey or purplish brown. The stripes are confined to tergites. Genitalia (Pl. XIX, Fig. 3) deep golden brown. Subgenital plate an inverted and spread U-shaped plate with the lateral pieces rather narrow. At the base of the "U" a wide, slightly concave line, showing where the plate is bent dorsally; there it consists of a pair of lateral triangular pieces separated by a large central triangular or diamond-shaped non-chitinized area which is so conspicuous as to be useful in recognizing the species at a glance. The distal portion of the subgenital plate or egg-guide bears chitinized strips laterally throughout its entire length, is longer than wide and broader proximally than distally; the distal margin is deeply notched. Lateral gonapophyses large, elongate and pilose. The projection from the chitinized strip connecting the gonapophyses of the ninth segment short, triangular. Sense tubercles on paraprocts rather small, pale. Suranal plate cap-like, short, wide, almost rectangular except that the distal margin is slightly convex.

Female (*brachypterous*):

The wings are of about three sizes. Those that average about .8 mm. long, 1.25 mm. and 1.6 mm. The venation may readily be recognized as that of *Peripsocus* in the larger winged individuals but as the wings diminish in size, aberrations and incomplete venation are common. (Pl. XXI, Fig. 11). The body markings are essentially identical with macropterous forms.

Male:

Length of body 2.1 mm. ave. of 10 individuals.

Length of fore wings 2.55 mm. ave. of 10 individuals.

Length of antennæ 2.05 mm. ave. of 10 individuals.

The male, while marked in general as the female, less robust throughout; spots on the vertex very small or obscured in dark individuals; the eyes ovate, very large—almost three times as large as female; antennæ longer and stouter. Fore wings are

possibly more nearly a uniform pale brown throughout than the female. Abdomen creamy white with a few coarse greyish brown bands; in dark individuals the dark brown of head, thorax and genitalia are in striking contrast to the white of the abdomen.

Genitalia (Pl. XIX, Fig. 6) symmetrical. The conspicuous parameres are fused. They are four times as long as at their widest measurement. The basal fourth is a narrow plate where it then forks and halfway each branch forks again, the outer pair of elements being very slender rods which gradually diverge until at about the distal fifth they almost meet and are then capped by a narrow sharp-pointed piece; the inner elements of the secondary forking are leaf-shaped, the basal half consists of an exceedingly slender pedicel while the narrow leaf-like portion gradually comes to a point distally. The hypandrium covers the distal half of the parameres; it bears a weakly chitinized triangular portion midway, the apex of which is at the distal margin; a pair of narrow strongly chitinized strips are on each side of the median line. The penis (?) is strongly chitinized and like *quadrifasciatus* may be likened to an anchor in shape—the lateral arms were not found crossed. Paraprocts elongate, the proximal half occupied by the large sense area and the distal half composed of two divisions, the larger apical part bulbous. Suranal plate an isosceles trapezoid with a circular chitinized area medianly.

New York: Ithaca, July 5, 1926, 3 ♀ 2 ♂, July 11, 1926, 12 ♀ 1 ♂ in dead leaves on fallen trees, July 24, 1927, 10 ♀ (2 *brachypterous*), July 25, 1925, 2 ♂ under loose bark, Aug. 6, 1926, 30 ♀ (10 *brachypterous*), 12 ♂ 2 nymphs, beating dead limbs, Aug. 15, 1926, 8 ♀ 6 ♂ 1 nymph, Aug. 22, 1926, 6 ♀ (2 *brachypterous*), 1 ♂, Aug. 28, 1926, 1 ♀ (P. P. Babi), Aug. 30, 1926, 3 ♀ *brachypterous*, 4 ♂ 3 nymphs (P. P. Babi) on *Plantus occidentalis*, Sept. 1, 1926, 2 ♀ 6 ♂ (P. P. Babi), Sept. 6, 1926, 1 ♀, Sept. 12, 1926, 2 ♀, Sept. 26, 1926, 13 ♀ (6 *brachypterous*) 7 ♂ 2 nymphs, Oct. 2, 1925, 1 *brachypterous* ♀ under loose bark of sycamore; Olcott, Sept. 19, 1925, 1 ♂; Enfield Center, Sept. 30, 1927, 8 ♀ (1 *brachypterous*) 2 ♂ 2 nymphs (Chester Rea) on willow woodpile; McLean, July 31, 1926, 1 ♀; Richburg, Sept.

16, 1925, 6 ♀ in dead leaves; Wellsville, Sept. 15, 1925, 1 ♀; Barcelona, Sept. 19, 1925, 2 ♀; Ceres, Sept. 16, 1925, 9 ♀ 3 ♂ on dead limbs; Rock City, Sept. 16, 1925, 28 ♀ 10 ♂; Clarksburg, Sept. 18, 1925, 4 ♀; Sodus, Aug. 16, 1926, 1 ♀ 2 ♂ 2 nymphs on dead maple limb; Painted Post, Sept. 15, 1925, 1 ♀ 1 ♂ on tree trunks; Little Valley, Sept. 17, 1925, 2 ♀ 1 ♂; Stow, Sept. 17, 1925, 2 ♀; Ballston Lake, July 14, 1926, 2 ♀; Hudson, July 15, 1926, 1 ♀; Saratoga Springs, July 14, 1926, 1 ♀; Adirondack Lodge, Essex Co., Sept. 2, 1927, 1 ♂; Paul Smiths, Aug. 31, 1927, 6 ♀ 4 ♂; Nigger Pond, Oswego Co., Sept. 3, 1926, 3 ♀; Whetstone Gulf, Lewis Co., Sept. 3, 1926, 2 ♀; Parkers, Lewis Co., Sept. 2, 1926, 2 ♀ 1 ♂; Michigan Mills, Lewis Co., Sept. 1, 1926, 1 ♀ 2 ♂; Riverhead, L. I., Oct. 1, 1924, 1 ♂; Sea Cliff, L. I., Sept. 6, 1925, 7 ♀ 2 ♂; Cinnamon Lake, Schuyler Co., July 14, 1924, 1 ♂; "N. Y." 1 ♀ (Winthem) M. C. Z. Type series.

Maine: Sebasticook Lake, Aug. 24, 1925, 1 ♂ (C. R. C.).

Vermont: Pownal, Oct. 2, 1927, 1 ♀ (*brachypteros*) (S. C. Bishop).

Ohio: Sandusky, July 22, 1926, 1 ♀ (*brachypteros*) on trunk of elm tree in city.

Illinois: Anderson, Sept. 17, 1902, 5 ♀ 5 ♂ many nymphs. Bark of maple.

Kentucky: Valley View, June 28, 1925, 1 ♀; Quicksand, June 25, 1925, 1 ♂ misc. beating.

Tennessee: Bristol, Oct. 5, 1926, 2 ♂ (C. & B.) taken at light of Coca-cola stand.

Two species are found in Hagen's type of *madidus*. I am here considering the specimen from New York collected by Winthem as the holotype; the specimen from Dalton, Georgia, is *quadrifasciatus*. That Hagen had the New York specimen most in mind is indicated by the following points: he listed it first; the pair of spots on the occiput mentioned in his description are not found in other American species; he mentions "two paler obsolete bands" while in *quadrifasciatus* three hyaline or subhyaline bands may be distinguished; a label, probably Hagen's, on the New York form bears the following—"P. *madidus* Hagen, Ps. 4-striatus Harr. Ps. *permadidus* Walsh."

Peripsocus permadidus Walsh is synonymous with *madidus* Hagen; the types are non-existent but Walsh's description makes clear what species he had in mind.

Dead limbs on deciduous trees appear to be the favorite feeding and breeding grounds of *P. madidus*. It is a common species. As far as known this is the only American species of *Peripsocus* with short-winged females. Males are frequently taken throughout the season while males of *madescens* are not known to me and those of *quadrifasciatus* are rare.

***Peripsocus quadrifasciatus* Harris**

Psocus quadrifasciatus Harris. Ento. Corresp. p. 331, 1869.

Peripsocus madidus Hagen. Verh. zool.-bot. Ges. Wein. 16: 210. 1866. (Partim).

Female:

Length of body 2.1 mm. ave. of 12 individuals.

Length of fore wings 2.4 mm. ave. of 12 individuals.

Length of antennæ 1.35 mm. ave. of 12 individuals.

Head: Vertex, covered with pale elongate golden brown dots except for a pair of unmarked crescents, one on each side of the ocelli; ocelli completely enclosed by a dark brown or blackish spot; clypeus covered with broad, nearly straight, pale, golden brown lines directed mesally; genæ unmarked; labrum brown, varying in intensity with the individual. Maxillary^a palpus and antennæ light brown throughout. Eyes dull black.

Thorax: Tergal lobes shining dark brown, the median lobe not as deeply colored, the sutures white; pleuræ light brown with considerable paling; legs pale throughout. Wings (Pl. XXI, Fig. 3) light greyish brown except for three irregular, incomplete hyaline or greyish bands which are so spaced as to divide the wing into four nearly equal sections. The middle band is wide, sometimes H-shaped and centered by a definite brown spot proximally in cell R_5 . The apical band narrow, and sometimes indistinct; it lies just beyond the pterostigma. Generally the marginal portion of the wing a pale greyish brown while the central portion between the bands darker, more brown than grey. Pterostigma opaque, R_1 almost parallel with costa

throughout its course. Veins brown, distinct. Hind wing uniformly pale grey with a pale border at wing margin and on each side of veins.

Abdomen: Dull white, usually ringed with grey especially on the sides; in some individuals are distinguishable a series of about ten longitudinal greyish stripes (the musculature). Genitalia (Pl. XIX, Fig. 2) light brown. The basal portion of the subgenital plate roughly crescent-shaped and without a median cleft as in the other American species; the plate convex becoming sharply so distally. The egg-guide rectangular almost as wide as long, convex, bounded laterally by a pair of wide, straight, highly chitinized strips leaving a median portion which is weakly chitinized and beset with short spines; the distal margin is concave and pilose. The gonapophyses of the ninth segment arise from a roughly diamond-shaped frame, the small convex, pilose, lateral gonapophyses cover the extreme lateral angles while caudo-medianly arise the short, blunt dorsal gonapophyses. On this framework halfway lies a pair of long, slender, tongue-like pieces. Ventral gonapophyses of usual shape. Suranal plate a chitinized cap with a pair of roughly circular weakly chitinized spots proximally.

Male:

Length of body 1.5 mm. ave. of 10 individuals.

Length of fore wings 2.2 mm. ave. of 10 individuals.

Length of antennæ 1.85 mm. ave. of 7 individuals.

Wing markings as in female; body markings generally darker, sometimes obscured, especially on head. Eyes very large, ovate, nearly three times larger than female. Antennæ more robust. On costa of the fore wing just behind the pterostigma a curious thickening which is concave and three or more times longer than wide.

The abdomen slender, almost tubular. Genitalia (Pl. XIX, Fig. 7) symmetrical and featured by the broad Y-shaped plate or the fused parameres. Considerable variation has been observed in the proportional width of this plate at its base as compared with the widest distal measurement. Distally on it arise two pairs of processes; the upper and inner pair blunt pointed

and fused to the narrow chitinized portion of hypandrium; the lower outer pair are highly chitinized, bending sharply mesally and each element approaching the other closely and finally capped by a less highly chitinized funnel-like piece. The penis (?) is small, highly chitinized and suggesting an anchor in shape. Caudal margin of the hypandrium with definitely chitinized strips narrowing and finally disappearing mesally. Sense tubercles bulbose, situated proximally on a plate which is elongate, convex and of irregular outline. The suranal plate short, broad, and truncate distally, while the chitinization is confined to a marginal strip.

New York: Ithaca, July 5, 1926, 12 ♀, July 11, 1926, 27 ♀, July 25, 1925, 3 ♀ 2 nymphs under loose bark, Aug. 1, 1926, 7 ♀, Aug. 6, 1926, 18 ♀, Aug. 8, 1925, 7 ♀, Aug. 15, 1926, 25 ♀, Aug. 22, 1926, 10 ♀, Sept. 6, 1926, 1 ♀, Sept. 12, 1925, 10 ♀, Sept. 23, 1924, 1 ♀, Sept. 26, 1926, 13 ♀, Oct. 2, 1925, 1 ♀ feeding in numbers on bark of sycamore; Enfield Glen, Aug. 23, 1925, 6 ♀; McLean Reservation, July 31, 1926, 15 ♀ on dead hemlock, July 16, 1924, 6 ♀, Sept. 19, 1924, 1 ♀; Enfield Center, Sept. 30, 1927, 34 ♀ (Chester Rea) on willow woodpile; Woodwardia Swamp, Tompkins Co., Aug. 10, 1924, 8 ♀ 3 nymphs; Danby, Oct. 17, 1924, 1 ♀; Cinnamon Lake, Schuyler Co., July 4, 12, 1924, 9 ♀ on tree trunks; Montour Falls, Sept. 21, 1924, 9 ♀; Sodus, Aug. 16, 1926, 2 ♀ on dead maple limbs; Barcelona, Sept. 19, 1925, 2 ♀; Geneseo, Sept. 20, 1925, 15 ♀; Ceres, Sept. 16, 1925, 31 ♀ on dead limbs; Silver Creek, Sept. 18, 1925, 5 ♀; Stow, Sept. 17, 1925, 5 ♀; Painted Post, Sept. 15, 1925, 28 ♀ on tree trunks and dead limbs; Little Valley, Sept. 17, 1925, 6 ♀; Richburg, Sept. 16, 1925, 3 ♀; Elmira, Oct. 1, 1925, 7 ♀ on tree trunks; Penn Yan, Aug. 2, 1925, 1 ♀; Whetstone Gulf, Lewis Co., Sept. 2, 1926, 14 ♀; Michigan Mills, Lewis Co., Sept. 1, 1926, 101 ♀ miscellaneous beating hemlock, larch, spruce, willow, etc.; Paul Smiths, Aug. 31, 1927, 59 ♀ on dead larch, spruce, etc.; Parkers, Lewis Co., Sept. 2, 1926, 23 ♀; Nigger Pond, Oswego Co., Sept. 3, 1926, 20 ♀; Mt. McIntyre, Essex Co., Sept. 4, 1927, 4 ♀ taken at 4500 ft. confined exclusively to birch, July 24, 1925, 1 ♀ (C. & B.); Adirondack Lodge, Essex Co., Sept. 2, 1927, 20 ♀; Chapel

Pond, Essex Co., July 19, 1925, 1 ♀ (C. & B.), Sept. 19, 1925, 3 ♀ (S. C. Bishop); Avalanche Lake, Essex Co., July 24, 1925, 2 ♀ 2 nymphs (C. & B.); Fairhaven, Sept. 7, 1924, 2 ♀; Ballston Lake, July 14, 1926, 1 ♀; Hudson, July 15, 1926, 1 ♀; Saratoga Springs, July 14, 1926, 2 ♀; Hunter, Aug. 16, 1925, 18 ♀ beating hemlock, etc., also under loose stones; Sea Cliff, L. I., Sept. 6, 1925, 22 ♀ miscellaneous beating; Baiting Hollow, Suffolk Co., L. I., Sept. 19, 1926, 1 ♀; Mineola, June 26, 1926, 1 ♀.

Maine: Presque Isle, Aug. 26, 1925, 2 ♀ (C. R. C.); Winterport, Aug. 29, 1925 1 ♀ (C. R. C.); Molunkus Pond, Aug. 25, 1925, 1 ♀ (C. R. C.); Falmouth, Aug. 20, 1925, 1 ♀ (C. R. C.); Southwest Harbor, Mt. Desert Island, Aug. 31, 1926, 3 ♀ (C. P. Alexander); Beech Mt., Mt. Desert Is., Sept. 12, 1926, 3 ♀ (C. P. Alexander).

Ontario, Canada: Pointe au Babil, 7 ♀ on ground hemlock (L. Giovannoli).

Massachusetts: Cambridge, 1 ♀ (Harris) Boston Society of Natural History. Holotype *P. quadrifasciatus*.

New Jersey: Englewood Cliff, Sept. 6, 1925, 5 ♀ on dead oak limbs.

Virginia: Spottswood, Oct. 4, 1926, 2 ♀ (C. & B.).

Kentucky: Brooklyn Bridge, June 29, 1925, 1 ♀.

Tennessee: Mill Creek, below falls on Mt. Leconte, Oct. 10, 1926, 8 ♀ 2 ♂ (C. & B.); Summit of Mt. Leconte (6500 ft.), Oct. 10, 1926, 1 ♂ (C. & B.); Laurel Creek, Sevier Co., Oct. 8, 1926, 2 ♀ (C. & B.).

North Carolina: Base of Mt. Pisgah, Buncombe Co., Oct. 13, 1926, 1 ♀ (C. & B.); Cowee Mts., Swain Co., Oct. 15, 1926, 1 ♀ (C. & B.); Waynesville, Oct. 14, 1926, 3 ♀ (C. & B.); Jacksonville, Oct. 23, 1926, 1 ♀ (C. & B.).

Georgia: Dalton, 1 ♀ (O. Sacken) M. C. Z. Paratype of *P. madidus*; Tiger, Oct. 18, 1926, 6 ♀ (C. & B.).

Florida: Rock Bluff, Apr. 4, 1927, 1 ♀ (C. R. C.), Apr. 25, 1924, 1 ♀ (T. H. Hubbell); Camp Torreya, Liberty Co., 1 ♀ (T. H. Hubbell); The Glen, Marion Co., Mar. 6, 1927, 1 ♂ (M. D. Leonard).

Washington: Seattle, Aug. 7, 1927, 26 ♀ 43 ♂ (C. R. C.); Sol Duc Hot Springs, Aug. 12, 1927, 4 ♀ (C. R. C.); Edmonds, Aug.

16, 1927, 14 ♀ (C. R. C.); Longmire, Aug. 22, 1927, 22 ♀ (C. R. C.).

California: Palo Alto, Aug. 4, 1927, 1 ♀ on dead *Salix* branch (J. D. Hood).

Hagen's types of *Peripsocus madidus* includes two species. The one from Dalton, Georgia, is what I here consider *Peripsocus quadrifasciatus* Harris. The original description of *quadrifasciatus* appears in Harris "Entomological Correspondence" published in 1869. Just the left wing of one specimen remains of the original specimens in the collection of the Boston Society of Natural History. In Harris' notes at this institution appear this reference to the species: "Cambridge on fence north of Mr. Newell's garden in college yard, Sept. 9, 1837, in great numbers together." I have been unable to find any difference between *quadrifasciatus* and *P. subfasciatus* Rambur of Europe. The former species is so common and widespread in this country as to appear indigenous and therefore until male specimens can be carefully compared (I have examined only female specimens of *P. subfasciatus*) I shall consider *quadrifasciatus* distinct. The males of this species are rare as an examination of the distribution data will indicate. Males taken in the Pacific Northwest by Prof. C. R. Crosby appears identical with the forms taken in Eastern United States. More than one generation of *quadrifasciatus* must occur in the North; it is among the first to appear in early summer and among the last to disappear in the fall. In New York it is the most common woodland form. One finds it breeding in a great variety of situations; on cliff walls, on stones, on tree trunks, or having a home among dead or living hemlock needles or the leaves of deciduous trees.

***Peripsocus stagnivagus* new species**

Female:

Length of body 1.4 mm. ave. of 2 individuals.

Length of fore wings 1.5 mm. ave. of 2 individuals.

Length of antennæ 1.0 mm. measurement of 1 individual.

Readily distinguished from the other American members of the genus by its small size. Body markings similar to *quadrifasciatus* with the following differences: blackish spot enclosing ocelli smaller; tergal lobes on thorax a deep golden brown, median lobe as deeply colored as lateral ones;

the abdomen light greyish brown with the markings most distinct anteriorly on the sides. The wings (Pl. XXI, Fig. 5) pale greyish brown with several spots and streaks, slightly darker, brown, in the fore wings. In one specimen a series of six pale spots distally, one spot to each cell from R_1 to M_3 inclusive. Veins distinct, pale brown.

Genitalia (Pl. XIX Fig. 5) light brown. The subgenital plate with an inverted V-shaped basal portion, the arms rather narrow as in *madidus*. This basal portion is terminated by being bent under suddenly and at which point arises the short distal portion or egg-guide. It is generally similar in shape to the corresponding piece in *quadrifasciatus*. It differs in being slightly wider than long and while the lateral margins are marked by chitinized strips these supports have at their base slender, triangular, laterally directed plates which are relatively wide at point of attachment and become pointed distally. The lateral gonapophyses large, nearly attaining the base of the dorsal gonapophyses. Suranal plate with rounded distal margin and a crescent-shaped non-chitinized area basally.

North Carolina: Lake Waccamaw, Oct. 21, 1926, 1 ♀ (C. & B.). Holotype. Knotts Island, July 24, 1929, 1 ♀ Paratype.

South Carolina: Sumter, Oct. 20, 1926, 1 ♀ (C. & B.). Paratype.

Ectopsocus MacLachlan 1899

Type: *E. briggsi* MacLachlan 1899.

The cross-vein r-m is present in the hind wings of members of this genus; the forewings as in *Peripsocus* with Cu unbranched. A few short hairs occur on the veins and on wing margin but they are not readily visible. In 1901 Enderlein erected *Micropsocus* based on the presence of hairs on veins and wing margins, assuming that *Ectopsocus* was unhaired. Later he discovered this was not the case. The genitalia of the female consists of two pairs of gonapophyses and the subgenital plate bears what may be called an egg-guide. Male genitalia are extremely complicated, asymmetrical, while on the dorsum are elaborate secondary structures presumably concerned with copulation.

Ectopsocus californicus (Banks)

Peripsocus californicus Banks. Jour. N. Y. Ent. Soc. **11**: 237. 1903.

Female:

Length of body 1.95 mm. ave. of 10 individuals.

Length of fore wings 1.9 mm. ave. of 10 individuals.

Length of antennæ 1.6 mm. ave. of 10 individuals.

Markings tan, the wings hyaline with brown spots at ends of veins.

Head: Dotted areas on vertex tan; each ocellus with a crescent of orange pigment; clypeus indistinctly lineated with broad mesally directed tan lines; genæ and labrum unmarked. Maxillary palpus and antennæ concolorous with head, darkest apically while segment 1 and 2 of antennæ, light brown. Eyes dull bluish black.

Thorax: Dorsum pale, with the tergal lobes incompletely covered with tan; pleuræ generally pale with an illy defined tan and brown stripe midway. Legs pale, tibia and tarsi tan. Wings (Pl. XXI, Fig. 8) hyaline, fore wings with spots ranging from tan to brown at end of the veins and spot at junction of Rs with M. Pterostigma opaque, rectangular, about four times longer than wide; a brown spot at each end of cell. Veins distinct, tan, darkening to light brown distally. Hind wing unmarked.

Abdomen: Tergites with broad greyish brown stripes fading or disappearing dorsally. Genitalia (Pl. XVI, Fig. 13) tan, the subgenital plate considerably longer than wide, with the chitination confined to a pair of lateral stripes. A distal process resembles the letter W due to the presence of elongate lateral lobes and a much shorter triangular middle portion. A small distinct chitinated area at the angles of the distal margin while just below these a concave row of six distinct bristles. The gonapophyses consist of a pair of short, slender blades directed mesally below the subgenital plate and to which is attached proximally a pair of long slender curved gonapophyses extending as far caudally as the end of lateral lobes of the subgenital plate. The proximal third of this piece is very slender and the lateral surface is sparsely pilose. Sense tubercles of paraprocts brown, very small. Suranal plate short, distal margin wide bearing a row of four conspicuous bristles.

Male:

Genitalia (Pl. XIX, Fig. 10). Hypandrium large, rectangular, the greatest dimension being in depth, the chitination being

confined to the lateral and distal marginal area; laterally at the distal margin arise a pair of short curved hooks. The parameres and what is probably a penis more or less united, asymmetrical. Parameres nearly independent consisting of a pair of scroll-like arms widest at base, becoming dilated, then suddenly narrowing to a very slender rod with a blunt pointed apex; lying between these arms distally a structure—probably the united inner pair of parameres—shaped like the letter π . The right arm of the π -shaped piece attached to the base of a large, strongly chitinized sickle-shaped piece which proceeds to the left; below and to the right lies an outer plate bound at the base by a highly chitinized strip, while behind, the two horizontally directed plates are visible; at the base of the left paramere a C-shaped piece. Sense tubercles of paraprocts very small. The apex of the suranal plate weakly chitinized bearing four spines noticed in the female. Cephalic of apex is found a large concave plate bound by a straight chitinized strip distally and by thin nearly parallel lateral strips which converge mesally near the small highly chitinized crescent-shaped piece lying midway proximally.

New York: Sea Cliff, L. I., Sept. 6, 1926, 20 ♀ in dead leaves, etc.

Virginia: Spottswood, Oct. 4, 1926, 7 ♀ (C. & B.); New Market, Oct. 4, 1926, 1 ♀ (C. & B.); Blue Ridge Mts. near Roanoke, Oct. 7, 1923, 6 ♀ 1 nymph (C. & B.); Fredericksburg, Oct. 28, 1926, 1 ♀ (C. & B.); Blacksburg, Oct. 4, 1926, 22 ♀ 7 nymphs (C. & B.).

Kentucky: Quicksand, June 25, 1925, 3 ♀ 1 nymph.

North Carolina: Nantahala Gap, Macon Co., Oct. 16, 1926, 12 ♀ 2 nymphs (C. & B.); Mine Hole Gap, Buncombe Co., Oct. 17, 1923, 2 ♀ (C. & B.); base of Mt. Pisgah, Buncombe Co., Oct. 19, 1923, 1 ♀ (C. & B.), Oct. 13, 1926, 8 ♀ (C. & B.); Frying Pan Gap, Mt. Pisgah, Oct. 13, 1926, 1 ♀ (C. & B.); Andrews, Oct. 17, 1926, 4 ♀ (C. & B.); Montreat, Oct. 16, 1923, 2 ♀; Marshall, Oct. 12, 1926, 1 ♀; Weldon, Oct. 26, 1926, 2 ♀; Olean, Oct. 13, 1926, 2 ♀ (C. & B.).

Tennessee: Laurel Creek, Sevier Co., Oct. 8, 1926, 6 ♀ (C. & B.); Mill Creek, below falls on Mt. Leconte, Oct. 10, 1926, 10 ♀ (C. & B.).

Georgia: Tiger, Oct. 18, 1926, 12 ♀ (C. & B.); Tallulah Falls, Oct. 18, 1926, 1 ♀ (C. & B.); top of Blue Ridge, Towns and Rabun Co. lines, Oct. 18, 1926, 2 ♀ (C. & B.).

Florida: Orlando, Jan. 27, 1927, 18 ♀; April, 1927, 1 ♀ on citrus; Dec. 17, 1926, 5 ♀ (All O. C. McBride); Lake Hall, Leon Co., April 13, 1927, 8 ♀ 2 nymphs (C. R. C.); Dead Lake, Wewahitchka, April 6, 1927, 6 ♀ (C. & B.).

California: Blue Lake, July 27, 1927, 1 ♂ (J. D. Hood) on dead *Salix*. "Calif." 1 ♀ 1 ♂ (M. C. Z.). Holotype and Allotype.

***Ectopsocus pumilis* (Banks)**

Peripsocus pumilis Banks. Mus. Comp. Zool. Bul. 64: 313. Pl. 6, Fig. 79. 1920.

Female:

Length of body 2.0 mm. ave. of 7 individuals.*

Length of fore wings 1.7 mm. ave. of 10 individuals.

Length of antennæ 1.1 mm. ave. of 10 individuals.

Head, thorax and genitalia concolorous, a deep greyish orange; abdomen pale, faintly and broadly ringed with pinkish grey.

Head: Vertex sparsely clothed with short hairs. Antennæ and maxillary palpus concolorous with head, the former paling distally. Eyes dull bluish black. Ocelli large, pale; ocellar interval concolorous with vertex. The head is wide and short.

Thorax: Several conspicuous short hairs on dorsum. Wings (Pl. XXI Fig. 15) tan or pale salmon throughout. Veins stout reddish brown. M usually joined to Rs for only a short distance, varying to individuals with a short cross-vein. Hind wing slightly paler than fore wing; cross-vein r-m distinct.

Genitalia characterized by a strongly chitinized *asymmetrical* interior genital plate (Pl. XIX, Fig. 12). The subgenital plate is triangular with lateral strip definitely chitinized forming a V. The apex is slightly depressed, weakly chitinized. But at-

* Some females full of eggs may have a body measurements as much as 2.6 mm.

tached below and to the inner surface a short wide plate which at its attachment is strongly chitinized. The only gonapophyses-like structures are the pair of stout curved pointed arms arising in a normal position from the tergites. These pieces bear four hairs distally: three in a row along inner margin, and one near outer margin. The interval between these "gonapophyses" at their base bridged over and supports the inner genital plates: the proximal part of this piece is circular, with a large median hole. Attached to this punctured plate cephalically are two asymmetrical, oblong, concave plates. They are connected by a weakly chitinized portion extending from the mesal margin of the left one to the inner convex surface of the right one. Sense tubercles on paraprocts small, proximal; a row of about four long hairs a short distance distal of sense tubercles; at distal margin of paraprocts an area covered with short hairs. Suranal plate triangular, pilose, a conspicuous pair of long hairs at the weakly chitinized apex.

Male:

Length of body 1.7 mm. ave. of 10 individuals.

Length of fore wings 1.5 mm. ave. of 10 individuals.

Length of antennæ 1.1 mm. ave. of 10 individuals.

Slightly smaller than female, eyes no larger; abdomen slender, more deeply colored on the average (in some individuals strongly marked with purplish grey). Genitalia (Pl. XIX, Fig. 11) asymmetrical. Hypandrium very large, nearly square. A little distal of halfway laterally, arise a pair of curved arms which are fused to the hypandrium but extend a short distance beyond its distal margin. The mesal margin of these arms strongly defined while attached to the lateral margin a strip connected to the elaborate genital armature on dorsum. The distal margin of hypandrium bears a row of long hairs. Attached at a point mesally on proximal margin a narrow weakly chitinized plate. A large U-shaped piece, the base of the parameres, gives rise to a pair of slender twisted, then finely drawn out pointed prongs. The interval between the origin of these prongs is spanned by an inverted U (the inner parameres?) which widens suddenly medianly and bears a small tubercle on the otherwise straight

distal margin. Attached to this bridge and proceeding cephalically into abdomen a very long, tongue-like plate. The strongly chitinized piece (the penis?) lying below the bridge is a complicated series of twisted plates. A median and most caudal piece is elongate, gradually widening distally and ending abruptly with an uneven rounded margin. On its left and almost its length a pointed prong which is divided proximally. The upper branch is unattached. The inner arm gives rise to two plates, of which the caudal one is narrow, curves up, and terminates in a point medianly at base of the first named structure; the cephalic plate parallels roughly the caudal one but is much broader, the upper margin produced into two prongs medianly and one on the left. An elongate, much twisted plate lies cephalic to the structures just named. Paraprocts weakly chitinized, sense tubercles distinct. The striking dorsal genital armature is concave (Pl. XIX, Fig. 4) the chitinization forming an elongate "O." The cephalic portion consisting of a large, flat, blunt, mesally curved prong on the left and a smaller prong on the right which curved mesally and then laterally; at origin of right prong a short, nearly square plate. Caudally the "O" curves up into a crescent-shaped plate.

New York: Riverhead, L. I., Oct. 1, 1924, 1 ♀ 1 ♂; Sea Cliff, L. I., Sept. 6, 1925, 8 ♀ 2 ♂ in dead oak leaves which were still attached to cut limbs; Long Pond, Suffolk Co., Sept. 19, 1926, 10 ♀ 10 ♂ in dead oak leaves on broken branch.

Virginia: Lynnhaven Inlet, Oct. 27, 1926, 2 ♀ 3 ♂ (C. & B.).

Kentucky: Quicksand, June 25, 1925, 14 ♀ 8 ♂ breeding in straw and débris indoors, 3 ♂ entangled in wet paint on newly painted house (associated with *Lachesilla pedicularia* L.).

Missouri: Creve Coeur Lake, Aug. 4, 1926, 1 ♀ (C. R. C.).

Tennessee: Mill Creek, below falls on Mt. Leconte, Oct. 10, 1926, 1 ♀ (C. & B.), also 1 ♂ at summit.

North Carolina: Summit of Big Bald, Pisgah Range, Oct. 13, 1926, 2 ♂ (C. & B.).

Georgia: Towns and Rabun Co. line, Oct. 18, 1926, 7 ♀ 4 ♂ (C. & B.); Tiger, Oct. 18, 1926, 1 ♂ (C. & B.); Spring Creek, Seminole Co., April 11, 1927, 2 ♂ (C. R. C.).

Louisiana: Baton Rouge, Feb. 15, 1927, 10 ♀ 12 ♂ (O. W. Rosewall) at windows of feed barn.

Florida: Orlando, Aug. 2, 1926, 3 ♀ 2 ♂ (O. C. McBride); Jan., 1927, 2 ♀ 5 ♂ (O. C. McBride), April, 1927, 1 ♀ (C. P. Alexander); Dead Lake, April 6, 1927, 2 ♀ 3 ♂ (M. D. Leonard); Monticello, 1 ♀ (?) (Scammell) M. C. Z. Holotype.

The occurrence of *Ectopsocus pumilis* Banks in dwellings and breeding in many of the same situations as *Lachesilla pedicularia* L. suggests the possibility of this species being cosmopolitan in distribution and that *pumilis* is a synonym of some earlier named member of the genus. With material at hand it should be a simple matter to establish these points, since the genitalia in both sexes present a wealth of detail. *E. pumilis* is Southern in range. I do not know of specimens being taken North of Long Island, New York.

EXPLANATORY NOTE ON DISTRIBUTION DATA

The order followed in citing collections is as follows: locality, date, number of individuals of each sex; collector in parenthesis (omitted when author is collector); museum where specimens may be found (omitted when in author's collection), and finally miscellaneous note such as habitat, rank in type series and others. Omission of collector in listing specimens prior to 1924 and those credited to the several museums is due to incomplete data rather than that the author collected the specimens. The few abbreviations of collectors and institutions are:

(C. R. C.)—C. R. Crosby, Professor of Entomology at Cornell University.

(C. & B.)—Prof. C. R. Crosby and Dr. S. C. Bishop, Assistant Professor of Zoology at the University of Rochester.

M. C. Z.—The Museum of Comparative Zoology at Harvard University.

I. N. H. S.—Illinois Natural History Survey.

P. A. N. S.—Philadelphia Academy of Natural Sciences.

N. Y. S. M.—New York State Museum, Albany, N. Y.

PLATE XII

Ventral view of genitalia and terminal abdominal segments. Structures *in situ*.

- Figure 1. *Psocus crosbyi* n. sp. ♀
Figure 2. *Psocus montivagus* n. sp. ♀ (only subgenital plate and egg-guide.)
Figure 3. *Psocus floridanus* Banks ♀ (only subgenital plate and egg-guide).
Figure 4. *Psocus venosus* Burmeister ♀
Figure 5. *Psocus striatus* Walker ♀
Figure 6. *Psocus petiolatus* Banks ♀ (only subgenital plate and egg-guide).
Figure 7. *Psocus purus* Aaron ♀
Figure 8. *Psocus hoodi* n. sp. ♀
Figure 9. *Psocus confraternus* Banks ♀
Figure 10. *Psocus variabilis* Aaron ♀
Figure 11. *Psocus trifasciatus* Prov. ♀
Figure 12. *Psocus texanus* Aaron ♀ sur. pl = suranal plate, pt. = paraproct, s. t. = sense tubercle of paraproct, d. gon. = dorsal gonapophyses, l. gon. = lateral gonapophyses, v. gon. = ventral gonapophyses, e. g. = egg-guide, sg. pl. = subgenital plate.
Figure 13. *Psocus novæscotiæ* Walker ♀
Figure 14. *Psocus quietus* Hagen ♀
Figure 15. *Psocus bisignatus* Banks ♀

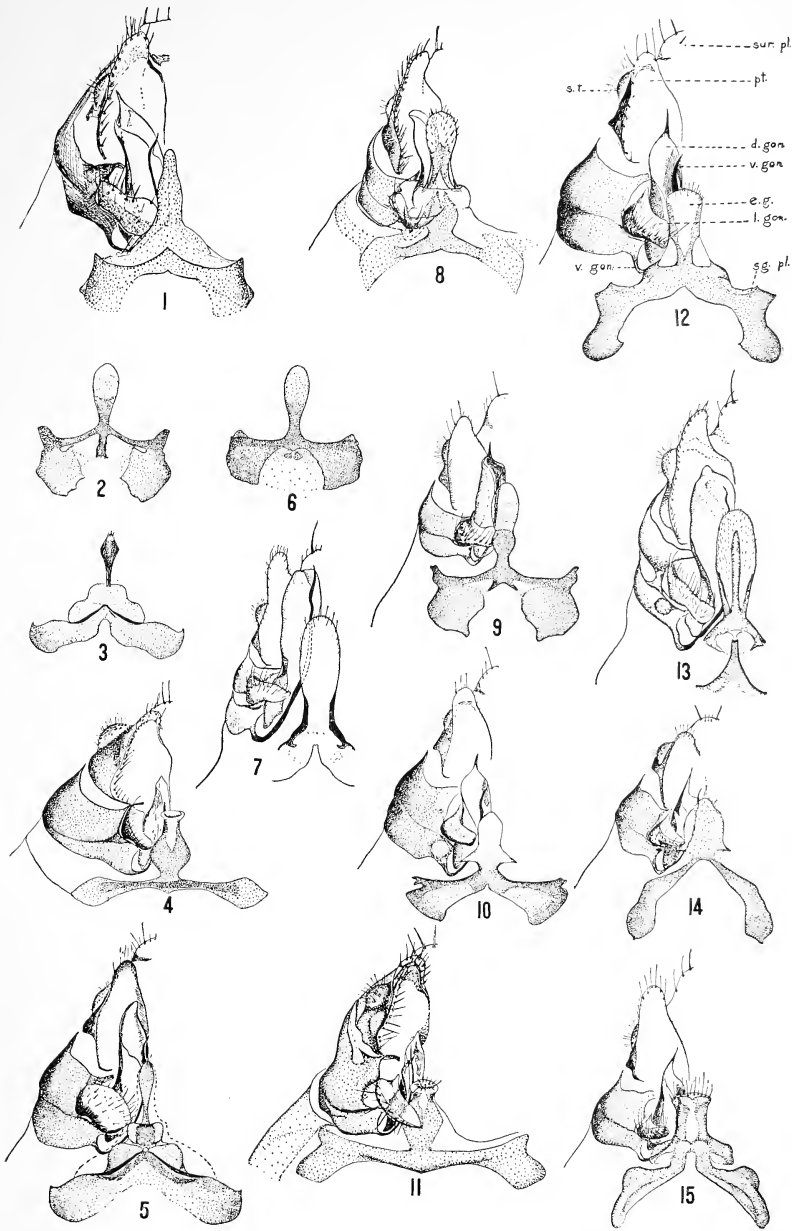


PLATE XIII

Ventral view of genitalia and terminal abdominal segments. Structures *in situ*.

- Figure 1. *Psocus elegans* Banks ♀
- Figure 2. *Psocus moestus* Hagen ♀
- Figure 3. *Psocus lithinus* n. sp. ♀
- Figure 4. *Psocus leidyi* Aaron ♀
- Figure 5. *Psocus atratus* Aaron ♀
- Figure 6. *Psocus pollutus* Walsh ♀
- Figure 7. *Psocus slossonæ* Banks ♀
- Figure 8. *Psocus infumatus* Banks ♀ (subgenital plate and egg-guide)
- Figure 9. *Psocus venosus* Burm. ♂ hypandrium and parameres.
- Figure 10. *Psocus quæsitus* n. sp. ♀
- Figure 11. *Psocus oregonus* Banks ♀
- Figure 12. *Psocus inornatus* Aaron ♀
- Figure 13. *Psocus oppositus* Banks ♀

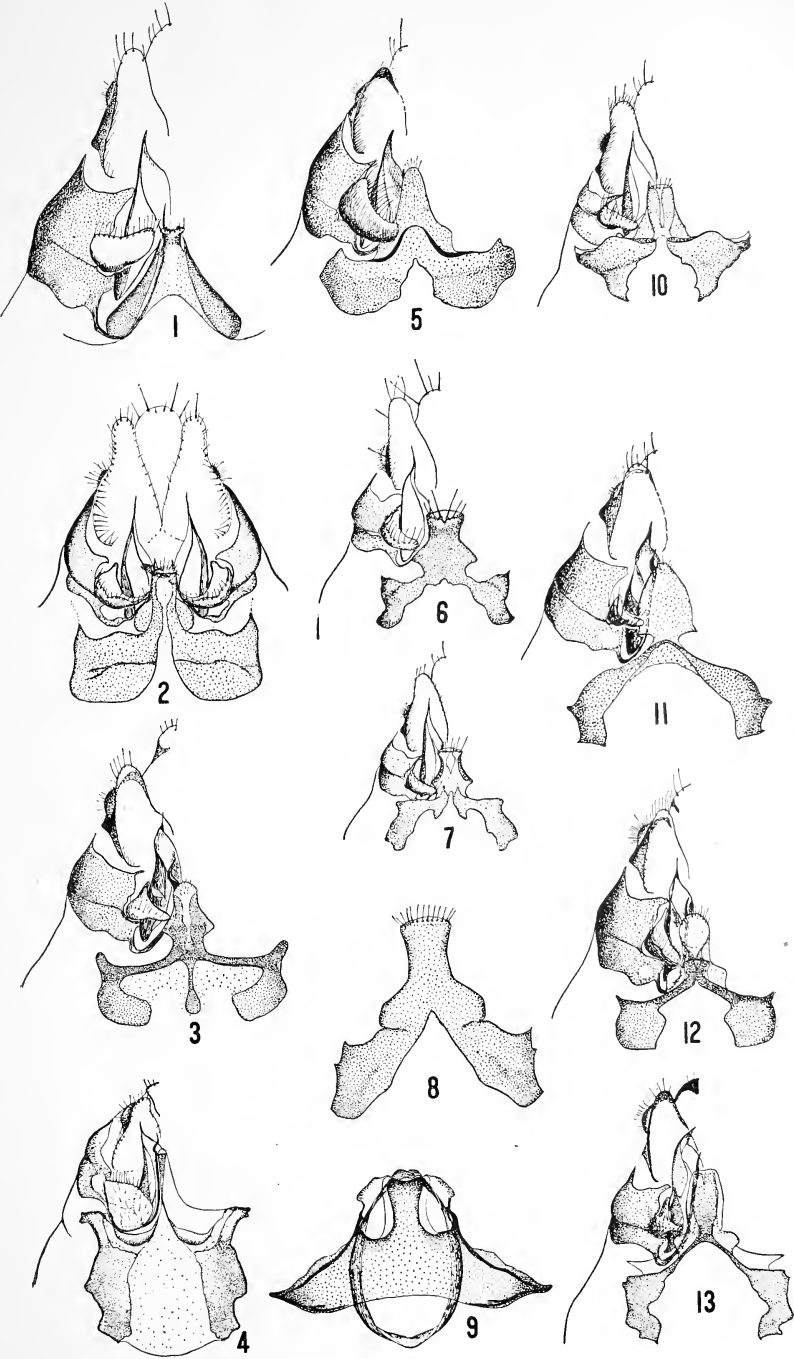


PLATE XIV

- Figure 1. *Psocus subapterous* n. sp. ♂ Hypandrium and parameres.
b. scl. = basal selerite, hyp. = hypandrium, par. = parameres.
- Figure 2. *Psocus longipennis* n. sp. ♂ Hypandrium and parameres.
- Figure 3. *Psocus quietus* Hagen ♂ Hypandrium and parameres.
- Figure 4. *Psocus infernicolus* n. sp. ♂ Hypandrium and parameres.
- Figure 5. *Psocus inornatus* Aaron ♂ Hypandrium and parameres.
- Figure 6. *Psocus confraternus* Banks ♂ Hypandrium and parameres.
- Figure 7. *Psocus montivagus* n. sp. ♂ Left paramere.
- Figure 8. *Psocus confraternus* Banks ♂ Left paramere.
- Figure 9. *Psocus petiolatus* Banks ♂ Left paramere.
- Figure 10. *Psocus petiolatus* Banks ♂ Apex of hypandrium from behind.
- Figure 11. *Psocus montivagus* n. sp. ♂ Apex of hypandrium from behind.
- Figure 12. *Psocus confraternus* Banks ♂ Apex of hypandrium from behind.
- Figure 13. *Psocus bifasciatus* Latr. ♂ Apex of hypandrium from behind.
- Figure 14. *Psocus infernicolus* n. sp. ♂ Apex of hypandrium from behind.
- Figure 15. *Psocus subquietus* n. sp. ♂ Hypandrium and parameres.
- Figure 16. *Psocus lithinus* n. sp. ♂ Hypandrium and parameres.
- Figure 17. *Psocus persimilis* Banks ♂ Hypandrium and parameres.
- Figure 18. *Psocus petiolatus* Banks ♂ Apex of hypandrium diagrammatic).
- Figure 19. *Psocus variabilis* Aaron ♂ Hypandrium and parameres.
- Figure 20. *Psocus oppositus* Banks ♂ Hypandrium and parameres.

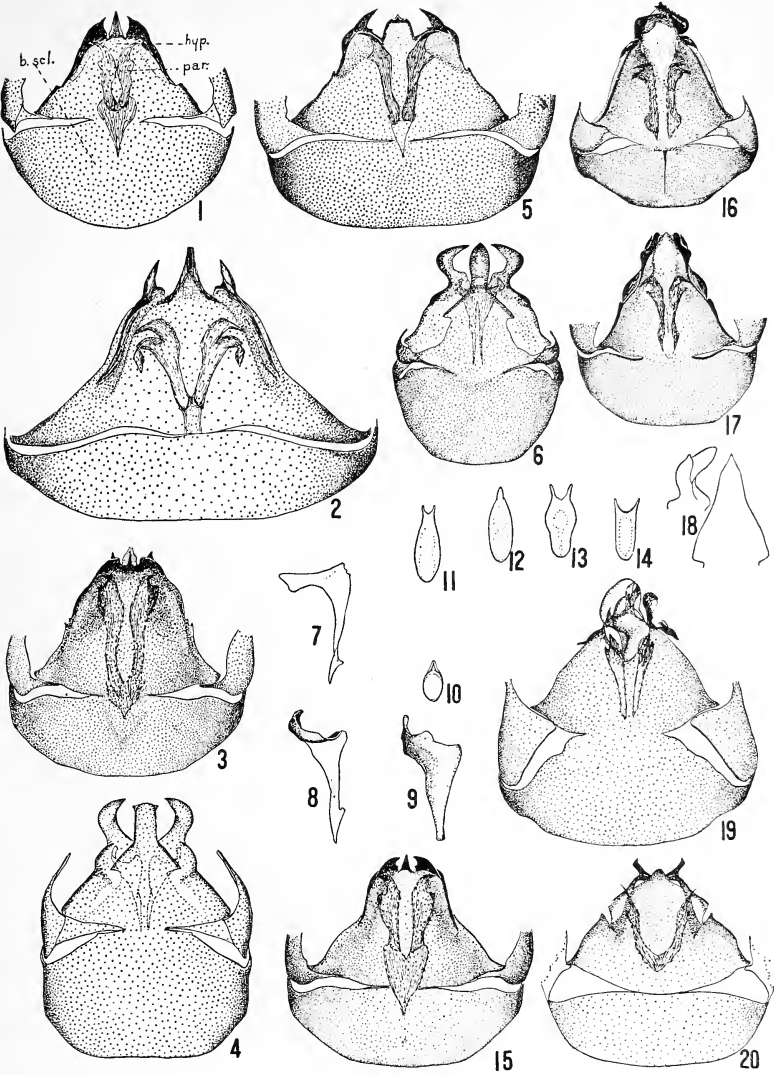


PLATE XV

- Figure 1. *Psocus hoodi* n. sp. ♂ Hypandrium and parameres.
Figure 2. *Psocus desolatus* n. sp. ♂ Hypandrium and parameres.
Figure 3. *Psocus floridanus* Banks ♂ Hypandrium and parameres.
Figure 4. *Psocus infumatus* Banks ♂ Hypandrium and parameres.
Figure 5. *Psocus leidy* Aaron ♂ Hypandrium and parameres.
Figure 6. *Psocus bisignatus* Banks ♂ Hypandrium and parameres.
Figure 7. *Psocus infumatus* Banks ♂ Parameres.
Figure 8. *Psocus insulanus* n. sp. ♂ Parameres.
Figure 9. *Psocus novæscotiæ* Walker ♂ Hypandrium and parameres.
Figure 10. *Psocus quæsitus* n. sp. ♂ Hypandrium and parameres.
Figure 11. *Psocus slossonæ* Banks ♂ Hypandrium and parameres.
Figure 12. *Psocus maculosus* (Banks) ♂ Median ridge on hypandrium.
Figure 13. *Psocus maculosus* (Banks) ♂ Parameres.
Figure 14. *Psocus striatus* Walker ♂ Hypandrium and parameres.
Figure 15. *Psocus leidy* Aaron ♂ Left paraprocts.
Figure 16. *Psocus leidy* Aaron ♂ Parameres.
Figure 17. *Psocus striatus* Walker ♂ Parameres.
Figure 18. *Psocus moestus* Hagen ♂ Hypandrium and parameres.
Figure 19. *Psocus bisignatus* Banks ♂ Parameres.
Figure 20. *Psocus purus* Walsh ♂ Hypandrium and parameres.
Figure 21. *Psocus texanus* Banks ♂ Hypandrium and parameres.
Figure 22. *Psocus floridanus* Banks ♂ Parameres.
Figure 23. *Psocus insulanus* n. sp. ♂ Hypandrium (3 missing from Fig. 23 on plate).

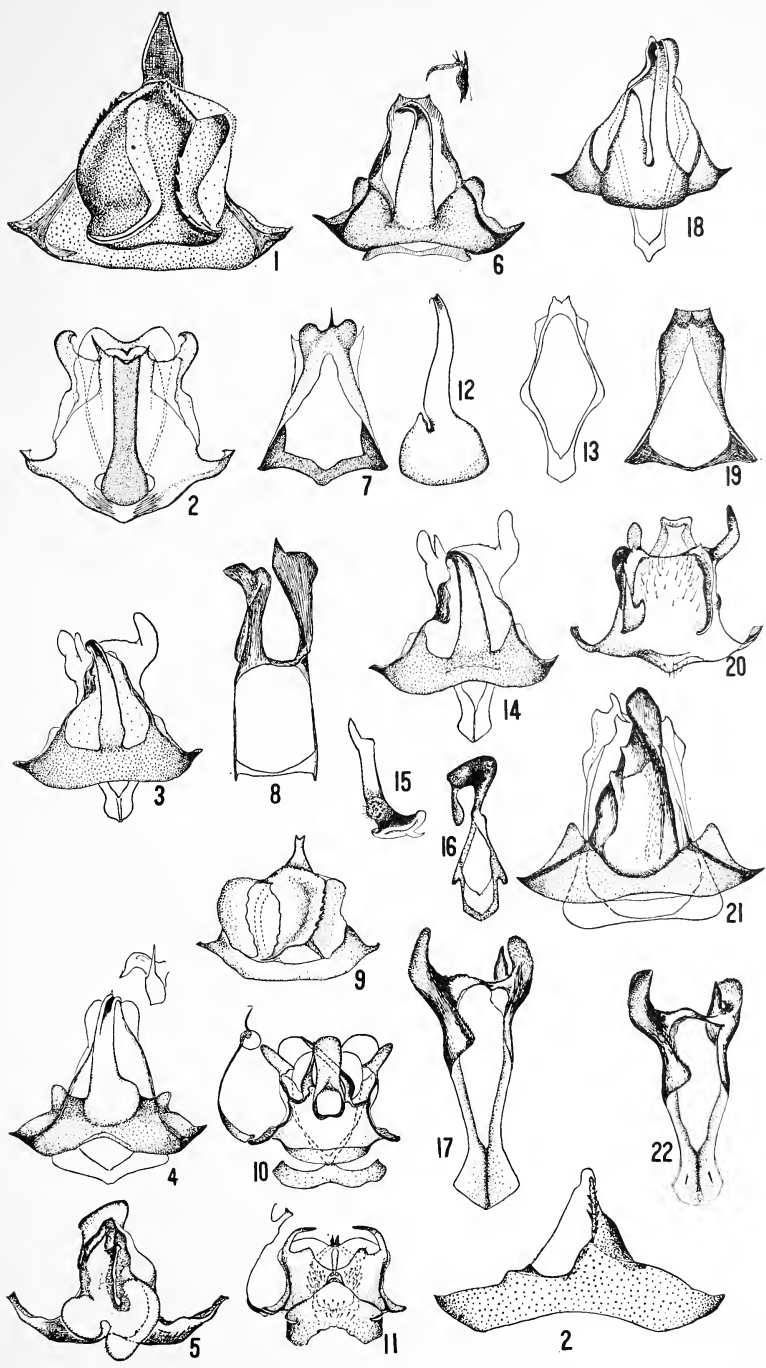


PLATE XVI

Ventral view of genitalia and terminal abdominal segments. Structures *in situ*.

- Figure 1. *Cæcilius quillayute* n. sp. ♀
- Figure 2. *Cæcilius aurantiacus* Hagen ♂
- Figure 3. *Cæcilius confluens* Walsh ♂
- Figure 4. *Teliapsocus conterminus* (Walsh) ♂
- Figure 5. *Cæcilius confluens* Walsh ♀
- Figure 6. *Graphopsocus cruciatus* L. ♂
- Figure 7. *Polypsocus corruptus* Hagen ♂
- Figure 8. *Teliapsocus conterminus* (Walsh) ♀
- Figure 9. *Cæcilius posticus* Banks ♀
- Figure 10. *Cæcilius aurantiacus* Hagen ♀
- Figure 11. *Cæcilius posticus* Banks ♂
- Figure 12. *Polypsocus corruptus* Hagen ♀
- Figure 13. *Ectopsocus californicus* (Banks) ♀

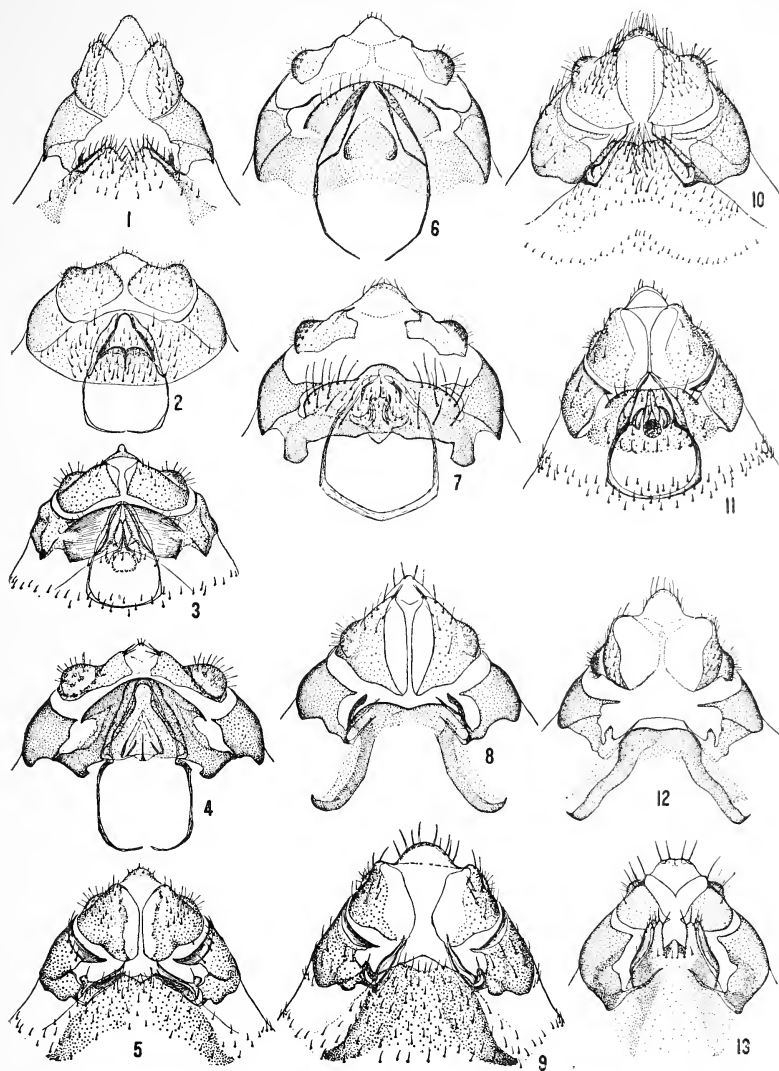


PLATE XVII

Ventral view of genitalia and terminal abdominal segments. Structures *in situ*.

- Figure 1. *Lachesilla nubilis* (Aaron) ♀
- Figure 2. *Lachesilla forcepeta* n. sp. ♀
- Figure 3. *Lachesilla silvicola* n. sp. ♀
- Figure 4. *Lachesilla corona* n. sp. ♀
- Figure 5. *Lachesilla pacifica* n. sp. ♀
- Figure 6. *Pseudocacilius pretiosus* (Banks) ♀
- Figure 7. *Terracacilius pallidus* n. gen., n. sp. ♀
- Figure 8. *Lachesilla arida* n. sp. ♀
- Figure 9. *Lachesilla rufa* (Walsh) ♀
- Figure 10. *Lachesilla contraforcepeta* n. sp. ♀
- Figure 11. *Lachesilla pedicularia* L. ♀
- Figure 12. *Lachesilla punctata* (Banks) ♀

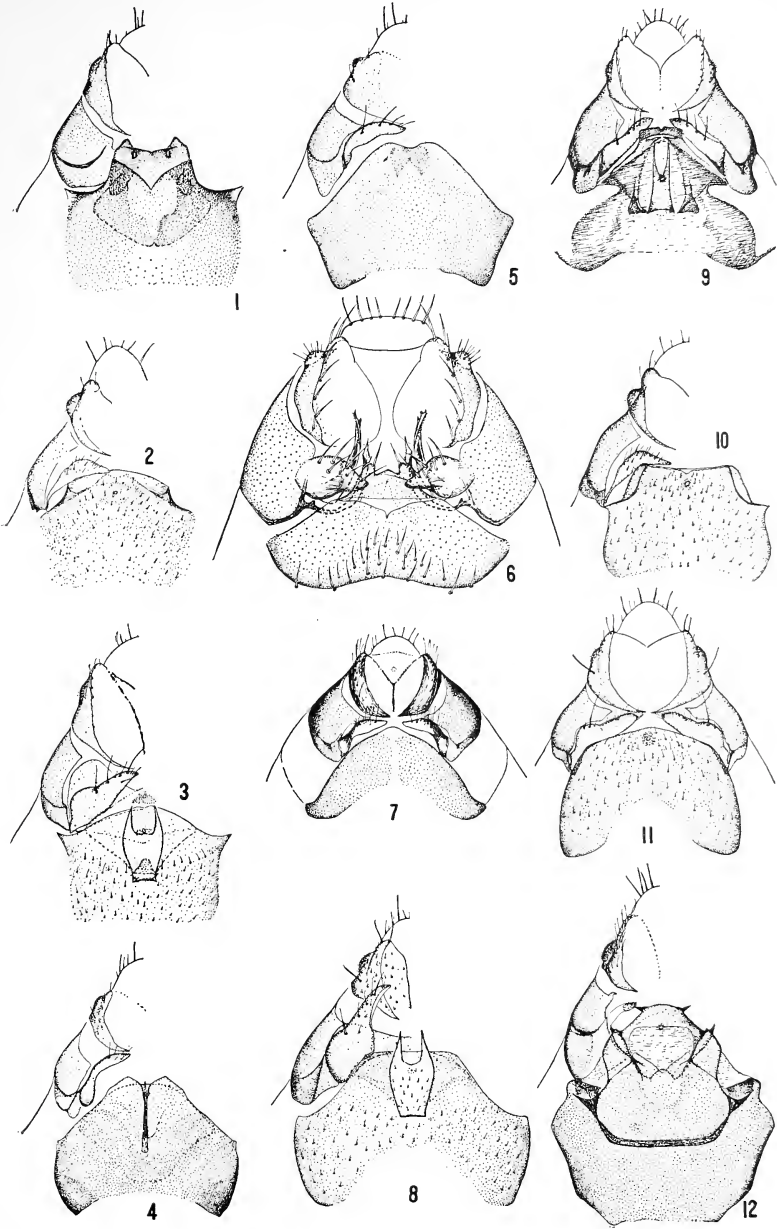


PLATE XVIII

Ventral view of genitalia and terminal abdominal segments. Structures *in situ*.

- Figure 1. *Lachesilla forcepeta* n. sp. ♂
- Figure 2. *Lachesilla pedicularia* L. ♂
- Figure 3. *Lachesilla rufa* Walsh ♂
- Figure 4. *Lachesilla contraforcepeta* n. sp. ♂
- Figure 5. *Lachesilla nubilis* Aaron ♂
- Figure 6. *Lachesilla forcepeta* var. *major* n. sp., n. var. ♂ left clasper.
- Figure 7. *Pseudopsocus amabilis* Walsh ♂
- Figure 8. *Lachesilla punctata* Banks ♂
- Figure 9. *Pseudopsocus amabilis* Walsh ♀ right gonapophyses.
- Figure 10. *Pseudopsocus amabilis* Walsh ♀ general view of genitalia.
- Figure 11. *Lachesilla corona* n. sp. ♂
- Figure 12. *Lachesilla silvicola* n. sp. ♂
- Figure 13. *Graphopsocus cruciatus* L. ♀

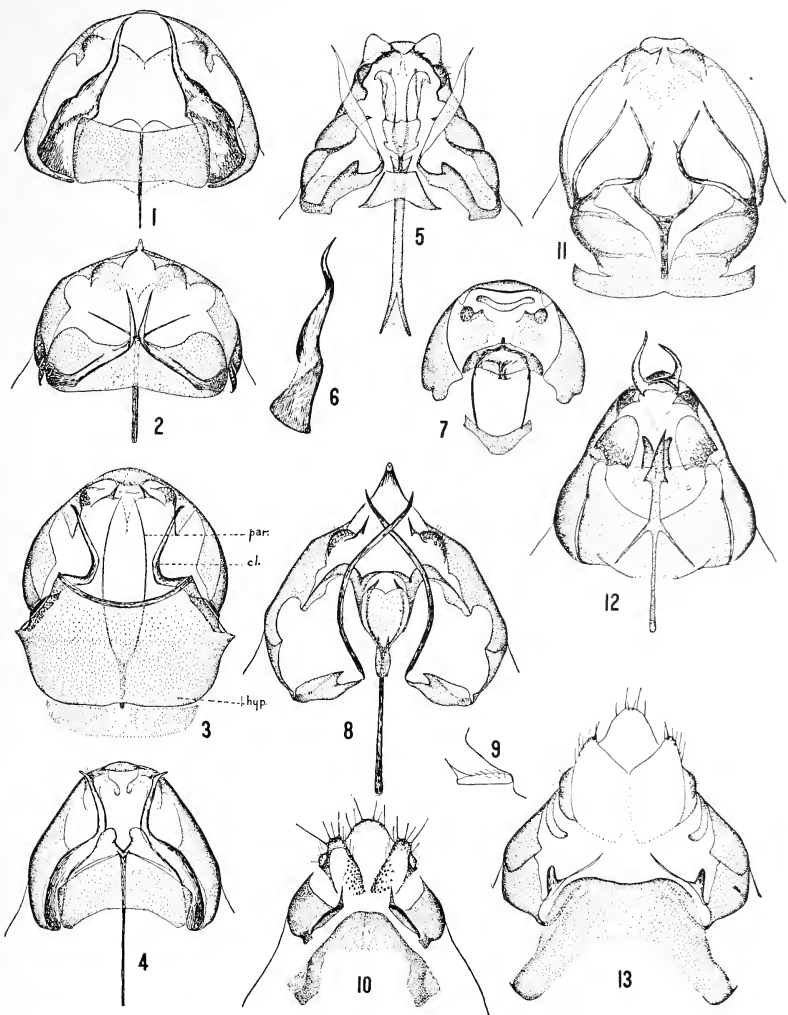


PLATE XIX

Ventral view of genitalia and terminal abdominal segments. Structures *in situ*.

- Figure 1. *Peripsocus madescens* (Walsh) ♀
Figure 2. *Peripsocus quadrifasciatus* (Harris) ♀
Figure 3. *Peripsocus madidus* Hagen ♀ sur. pl. = suranal plate, pt. = paraprocts, d. gon. = dorsal gonapophyses, l. gon. = lateral gonapophyses, v. gon. = ventral gonapophyses, e. g. = egg-guide, sg. pl = subgenital plate.
Figure 4. *Ectopsocus pumilis* (Banks) ♂ (Dorsal copulatory structures).
Figure 5. *Peripsocus stagnivagus* n. sp. ♀
Figure 6. *Peripsocus madidus* Hagen ♂ sur. pl. = suranal plate, pt. = paraproct, hyp. = hypandrium, pe. = penis, par. = parameres.
Figure 7. *Peripsocus quadrifasciatus* ♂ (Harris).
Figure 8. *Bertkauia lepicidinaria* n. sp. ♀
Figure 9. *Bertkauia lepicidinaria* n. sp. ♀ the gonapophyses.
Figure 10. *Ectopsocus californicus* (Banks) ♂
Figure 11. *Ectopsocus pumilis* (Banks) ♂
Figure 12. *Ectopsocus pumilis* (Banks) ♀

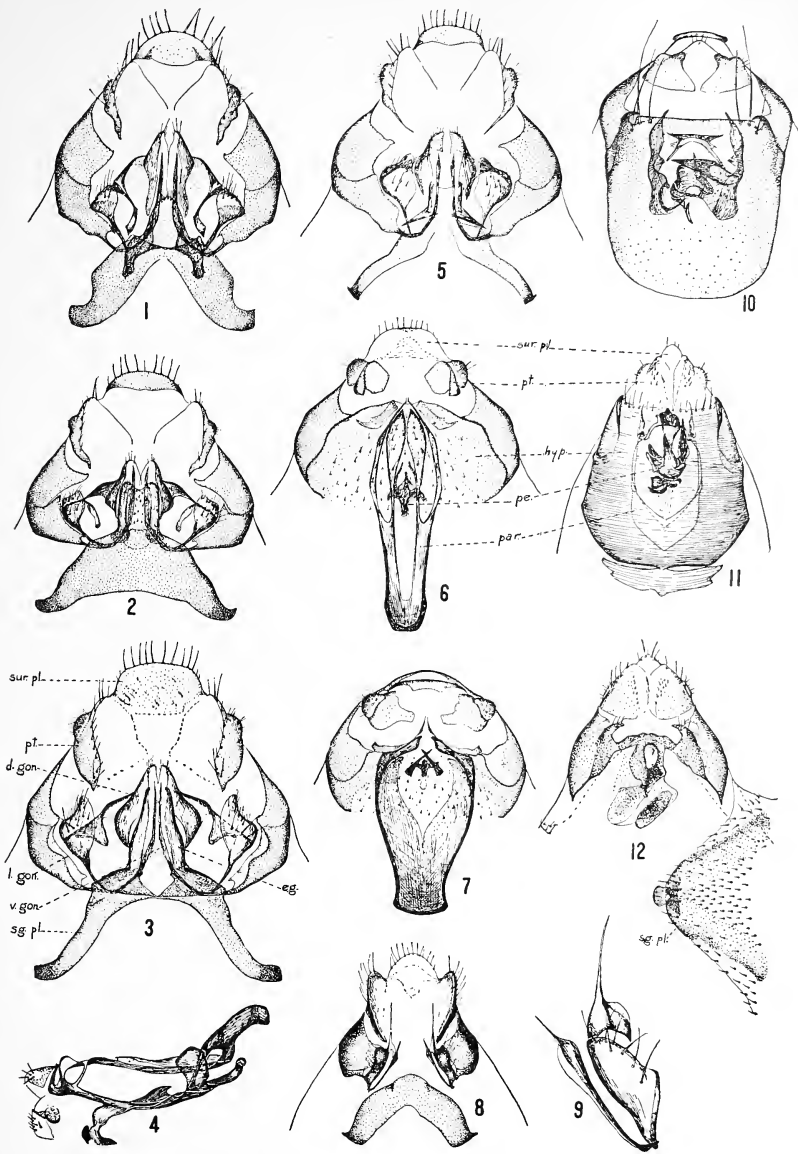


PLATE XX

- Figure 1. *Pseudopsocus amabilis* (Walsh) ♀ (×12).
 Figure 2. *Psocus purus* Walsh ♀ (×6).
 Figure 3. *Psocus slossonæ* Banks ♀ (×9).
 Figure 4. *Psocus novascotiæ* Walker ♂ (×5).
 Figure 5. *Psocus novascotiæ* Walker ♀ (×5).
 Figure 6. *Psocus longipennis* Banks ♂ (×5).
 Figure 7. *Psocus striatus* Walker ♀ (×7).
 Figure 8. *Psocus variabilis* Aaron ♀ (×9).
 Figure 9. *Psocus moestus* Hagen ♀ (×9).
 Figure 10. *Psocus confraternus* Banks ♀ (×7).
 Figure 11. *Psocus lithinus* n. sp. ♀ (×7).
 Figure 12. *Psocus leidyi* Aaron ♀ (×6).
 Figure 13. *Psocus infumatus* Banks ♀ (×8).
 Figure 14. *Psocus subapterous* n. sp. ♂ (×7).
 Figure 15. *Psocus hoodi* n. sp. ♀ (×6).
 Figure 16. *Psocus quietus* Hagen ♀ (×7).
 Figure 17. *Psocus atratus* Aaron ♀ (×13).
 Figure 18. *Psocus pollutus* Walsh ♀ (×8).
 Figure 19. *Psocus crosbyi* n. sp. ♀ (×6).
 Figure 20. *Psocus oppositus* Banks ♀ (×9).
 Figure 21. *Psocus trifasciatus* Provancher ♀ (×7).
 Figure 22. *Psocus texanus* Aaron ♀ (×8).
 Figure 23. *Psocus venosus* Burmeister ♀ (×5).
 Figure 24. *Psocus bisignatus* Banks ♀ (×9).
 Figure 25. *Psocus inornatus* Aaron ♀ (×10).
 Figure 26. *Psocus floridanus* Banks ♀ (×9).
 Figure 27. *Psocus petiolatus* Banks ♀ (×8).
 Figure 28. *Psocus maculosus* (Banks) ♀ (×9).
 Figure 29. *Teliapsocus conterminus* (Walsh) ♀ (×8).
 Figure 30. *Graphopsocus cruciatus* L. ♀ (×11). (3 missing from Fig. 30 on plate.)

The photomicrographs of the fore wings in Plates XX and XXI were made with apparatus described by Dr. F. P. McWhorter. "A simple and inexpensive method of making photomicrographs" in *Camera*, Dec., 1927.

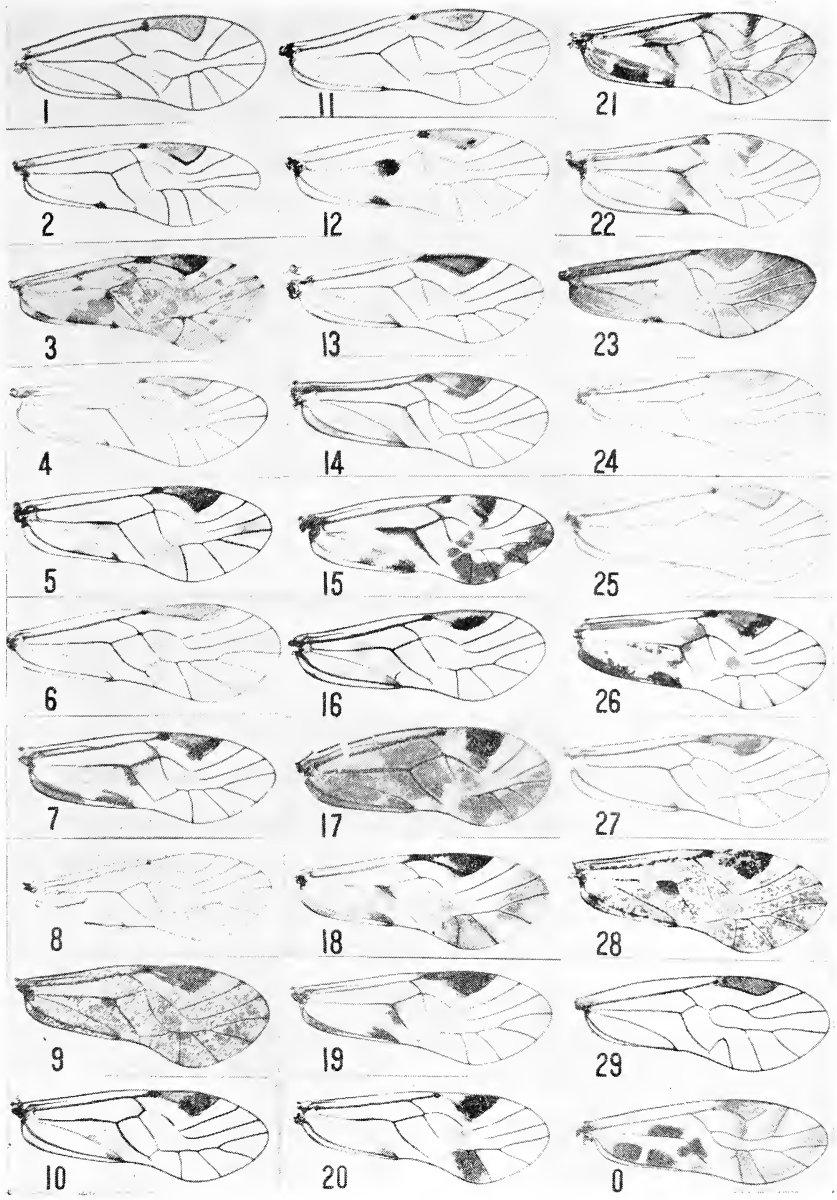
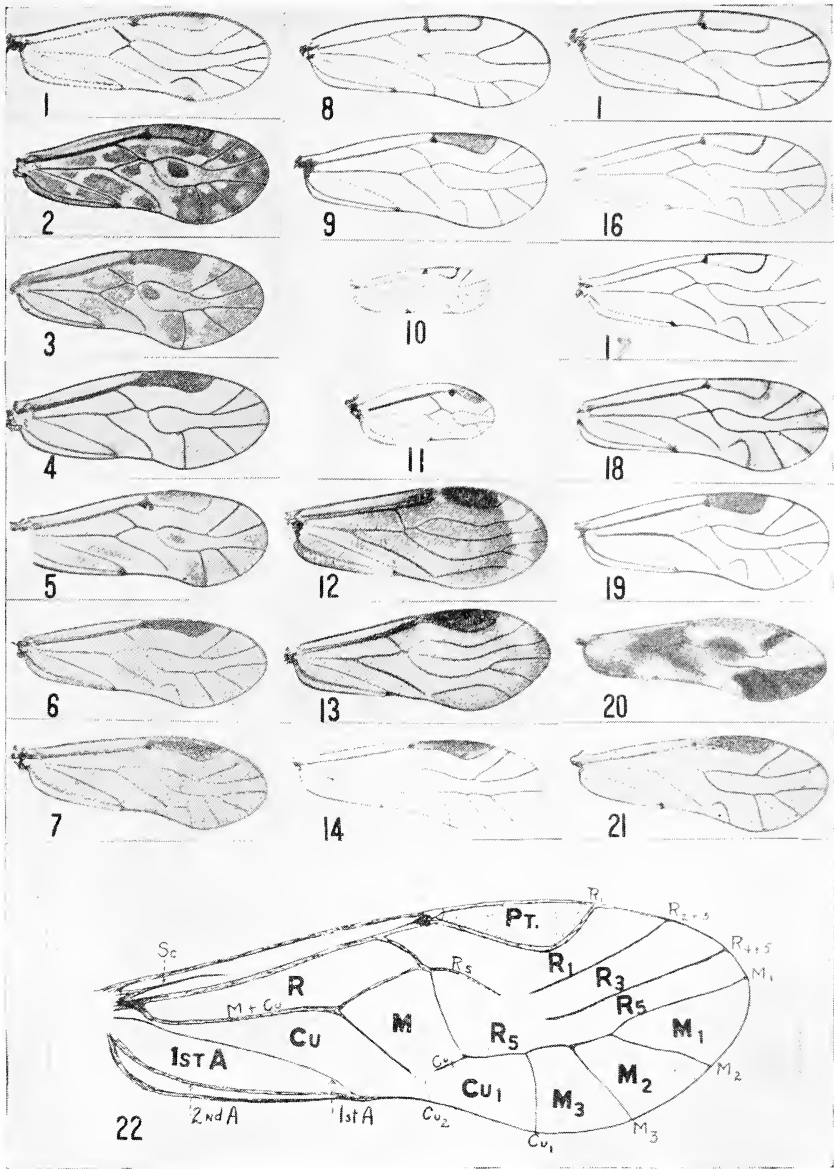


PLATE XXI

- Figure 1. *Pseudocæcilius pretiosus* (Banks) ♀ (×12).
Figure 2. *Peripsocus madescens* (Walsh) ♀ (×13).
Figure 3. *Peripsocus quadrifasciatus* (Harris) ♀ (×13).
Figure 4. *Peripsocus madidus* Hagen ♀ (×13).
Figure 11. *Peripsocus madidus* Hagen ♀ (*brachypterous*) (×13).
Figure 5. *Peripsocus stagnivagus* n. sp. ♀ (×22).
Figure 6. *Cæcilius perplexus* n. sp. ♀ (×10).
Figure 7. *Cæcilius cræsus* n. sp. ♀ (×14).
Figure 8. *Ectopsocus californicus* (Banks) ♀ (×17).
Figure 15. *Ectopsocus pumilis* (Banks) ♀ (×19). (5 missing from Fig. 15 on plate.)
Figure 9. *Lachesilla silvicola* n. sp. ♀ (×15).
Figure 10. *Lachesilla pedicularia* L. ♀ (dwarf) (×19).
Figure 17. *Lachesilla pedicularia* L. ♀ (×19). (7 missing from Fig. 17 on plate.)
Figure 12. *Polypsocus corruptus* Hagen ♀ (×9).
Figure 13. *Polypsocus corruptus* Hagen ♂ (×9).
Figure 14. *Cæcilius aurantiacus* Hagen ♀ (×11).
Figure 16. *Lachesilla rufa* (Walsh) ♀ (×12).
Figure 18. *Lachesilla nubilis* (Aaron) ♀ (×15).
Figure 19. *Lachesilla contraforcepeta* n. sp. ♀ (×20).
Figure 20. *Cæcilius posticus* Banks ♂ (×14).
Figure 21. *Cæcilius quillayute* n. sp. ♀ (×10).
Figure 22. Fore wing of *Psocus* with the principal veins and cells lettered.



NEW GENERA AND SPECIES OF NEOTROPICAL MEMBRACIDÆ

By W. D. FUNKHOUSER

UNIVERSITY OF KENTUCKY

Centronodus gen. nov.

Pronotum with strong suprahumeral horns and with large node in center of posterior process; scutellum exposed on either side of posterior process; posterior process extending to internal angles of tegmina; clavus acuminate; venation of terminal area of tegmina reticulate and irregular, forming numerous cellules; wings with four apical cells; head subquadrate, wider than long; ocelli equidistant from each other and from the eyes; tibiæ not foliaceous; tarsi normal. Type: *C. denticulus*.

Centronodus denticulus sp. nov. (Fig. 1)

Large, brown, coarsely punctate, sparingly pubescent; a small tooth on median line just behind suprahumeral and in front of central node; suprahumeral heavy, triquerate, extending outward and upward; tegmina coriaceous and opaque.

Head subquadrate, wider than long, roughly sculptured, coarsely punctate, sparingly pubescent with long golden hairs; base arcuate; ocelli large, amber-colored with white margins, slightly elevated, equidistant from each other and from the eyes and situated about on a line drawn through centers of eyes; genæ foliaceous and angulate; clypeus twice as long as wide, extending for one-third its length below inferior margins of genæ.

Pronotum rough, brown, mottled with black and yellowish, coarsely punctate, sparingly pubescent; metopodium straight, broader than high, a smooth depression on each side at base; humeral angles large, triangular, prominent, extending laterad farther than the eyes; median carina strong, percurrent; suprahumeral horns strong, heavy, about as long as the distance between their bases, triquerate, extending outward and upward with the tips suddenly bent outward; a distinct tooth on median line of dorsum just back of suprahumeral and in front of central node; posterior process heavy with a strong elevated node at base, tip tectiform and extending to internal angles of tegmina, a yellow fascia before the tip.

Scutellum narrowly exposed on each side; mottled brown and yellow; punctate; pubescent.

Tegmina brown, irregularly mottled with yellowish and black, coriaceous, opaque, veins heavy, apical area broken up into many irregular cellules, tip obtuse. Wings with four apical cells.

Undersurface of body brown; femora and tibiae banded brown and yellow; tarsi ferruginous.

Length from front of head to tips of tegmina 9 mm.; width between tips of suprahumeral 4.9 mm.

Type: male. Locality: Costa Rica.

Described from a single specimen. Type in author's collection.

Centronodus flavus sp. nov. (Fig. 2)

Large, yellow, punctate, not pubescent; suprahumeral heavy, stout, projecting outward and very slightly upward; crest on posterior process straight on front margin; no tooth before crest; basal third of tegmen opaque and coriaceous, apical two-thirds wrinkled hyaline, venation of apical area reticulate; undersurface and legs yellow.

Head subquadrate, wider than high, finely punctate, very sparsely pubescent, roughly sculptured; base arcuate; eyes large, gray; ocelli large, somewhat elevated, amber-colored, a little nearer to each other than to the eyes and situated a little below a line drawn through centers of eyes; genae foliaceous and truncate; clypeus about as long as wide, the inferior margin continuing the line of the genae.

Pronotum yellow mottled with brown, finely punctate, very sparingly pubescent; suprahumeral rough, heavy, subconical, extending outward and very slightly upward, about half as long as the distance between their bases, tips acute; humeral angles small, not prominent; metopidium sloping, twice as wide as high; median carina light yellow and strongly percurrent; posterior process heavy, extending to internal angles of tegmina, basal elevation perpendicular in front and sloping behind with a ridge on each side. No tooth in front of central node.

Scutellum narrowly exposed on each side of posterior process; yellow and brown mottled.

Tegmina opaque, punctate and coriaceous on basal third, translucent on apical two-thirds; veins heavy; venation of apical area irregular and broken up into many small cellules; tip rounded. Wings with four apical areas.

Undersurface and legs uniform yellow.

Length from front of head to tips of tegmina 8.5 mm.; width between tips of suprahumeral 4.5 mm.

Type: female. Locality: Pernambuco, Brazil.

Described from two specimens of the same sex from the same locality. Type and paratype in author's collection.

Orekthen gen. nov.

Pronotum extended in a porrect horn; scutellum entirely exposed; no posterior process; head not sulcate; ocelli far apart and lower than centers

of eyes; clavus acuminate; tegmina with five apical and two discoidal areas; wings with four apical areas; legs simple. Type: *O. osborni*. This genus is near *Eustollia* Goding but differs distinctly in head structure and in wing venation.

Orekthen osborni sp. nov. (Fig. 3)

Small, greenish-yellow, punctate, not pubescent; pronotum projecting in a porrect horn as long as its width at base with a longitudinal brown stripe on each side; scutellum entirely exposed; no posterior process; tegmina hyaline; undersurface and legs yellow.

Head subquadrate, yellow, roughly sculptured, not pubescent; base arcuate; slightly depressed at center; eyes red; ocelli very small, yellow, inconspicuous, twice as far from each other as from the eyes and situated distinctly below a line drawn through centers of eyes; clypeus twice as long as wide, projecting for half its length below inferior margins of genæ, tip rounded.

Pronotum greenish-yellow, punctate, not pubescent, extending in a single porrect horn upward and forward, tip blunt, a broad brown longitudinal fascia on each side; humeral angles large, blunt, triangular; metopidium triangular, as wide as high; median carina faintly percurrent; scutellum entirely exposed, triangular, smooth, tip acute; no posterior process.

Tegmina hyaline; clavus acuminate; veins punctate; tip rounded; five apical and two discoidal cells; no limbus; wings with four apical cells.

Sides of thorax, undersurface and legs uniform light yellow.

Length from front of head to tips of tegmina 4.7 mm.; from tip of pronotal process to tips of tegmina 5.4 mm.; width between humeral angles 1.7 mm.

Type: female.

The males are smaller and darker with light eyes and with very much shorter pronotal process. The tegmina of the males, also, are inclined to show darker areas in the basal and internal areas.

Described from three specimens, one female and two males, received from Professor Herbert Osborn and collected at Concepción, Chile, on January 31, 1923. Type and one paratype in author's collection; allotype in collection of Professor Osborn.

Dontonodus gen. nov.

Base of posterior process elevated above scutellum in an erect, arcuate, toothed node; scutellum exposed; suprahumeral horns present; posterior process reaching internal angles of tegmina; tegmina coriaceous, five apical and two discoidal cells, apical cells oblique; clavus acuminate; base of head bituberculate; legs simple. Type: *D. serraticornis*.

Dontonodus serraticornis sp. nov. (Fig. 4)

Large, mottled green and brown, coarsely punctate, sparingly pubescent; suprahumeral large, heavy, serrate; base of posterior process expanded into a denticulate semicircular crest; posterior process reaching tip of abdomen; scutellum exposed; tegmina opaque, five apical and two discoidal cells; clavus acuminate; base of head strongly nodulate; tibiae not foliaceous.

Head subquadrate, wider than long, roughly sculptured, brown, not punctate, densely pubescent; base expanded into two strong tubercles, basal margin sinuate; eyes large, prominent, gray; ocelli large, brown, equidistant from each other and from the eyes and situated about on a line drawn through centers of eyes; genæ flattened and projecting; clypeus twice as long as wide, extending for two-thirds its length below inferior margins of genæ.

Pronotum mottled green and brown, coarsely punctate, sparsely pubescent; metopidium wider than high; median carina strongly percurrent; humeral angles prominent, triangular; suprahumeral horns heavy, strong, flattened dorso-ventrally, tricarinate, extending outward and upward, twice as long as the distance between their bases, posterior margins strongly denticulate; scutellum well exposed, tip bifurcate; posterior process sinuate, extending to internal angles of tegmina, base elevated to form a toothed semicircular node, tip blunt and dark brown.

Tegmina opaque, coriaceous, mottled green and brown, distinctly pilose; clavus acuminate; two discoidal and five apical cells; apical cells oblique; tips pointed; no limbus.

Sides of thorax and undersurface of abdomen brown, pubescent; legs banded green and brown; tarsi black.

Length from front of head to tips of tegmina 9.6 mm.; width between tips of suprahumeral 4.7 mm.

Type: female.

Locality: Costa Rica.

Described from a single specimen in author's collection.

Eustellia variegata sp. nov. (Fig. 5)

Small, greenish mottled with brown, punctate, not pubescent; pronotal process curved forward over the head; scutellum entirely exposed; no posterior process; tegmina with five apical and four discoidal cells; wings with four apical cells; clavus acuminate; head subovate.

Head subovate, weakly sculptured, finely punctate, sparsely pubescent; a broad brown fascia across base, a narrow vertical line inside each ocellus and a narrow brown line at margins of genæ; base arcuate; eyes small, gray; ocelli large, prominent, yellow, nearer to each other than to the eyes and situated about on a line drawn through centers of eyes; clypeus twice as long as wide, extending for half its length below inferior margins of genæ.

Pronotum extended in a flattened horn curving over the head, twice as long as its width at base, punctate, not pubescent, mottled green and brown; median carina strongly percurrent; humeral angles small, blunt, inconspicuous; scutellum entirely exposed, triangular, tip acute; no posterior process.

Tegmina hyaline mottled with brown; veins prominent; basal area punctate; five apical and two discoidal cells; tips rounded; clavus acuminate; wings with four apical cells.

Sides of thorax, undersurface and legs mottled green and brown. Legs simple.

Length from front of head to tips of tegmina 5 mm.; from tip of pronotal process to tips of tegmina 6 mm.; width between humeral angles 1.7 mm.

Type: female.

Described from two females received from Professor Herbert Osborn and labeled "Prov. Valparaiso, Chile, Coll. A. Faz." One specimen has a shorter pronotal horn than the other and is somewhat darker but there seems to be no specific difference. Type in collection of Professor Osborn; paratype in author's collection.

***Mina spinosa* sp. nov. (Fig. 6)**

Small, brown, finely punctate, sparingly pubescent; pronotum convex; scutellum entirely exposed and extending backward in a fine hair-like spine; no posterior process; head strongly bilobed; tegmina smoky hyaline with five apical and two discoidal cells; clavus acuminate; wings with four apical cells; undersurface and legs brown.

Head yellow-brown, twice as long as wide, finely punctate, shining, not pubescent; base strongly bilobed; eyes small, dark brown; ocelli dark brown, twice as far from each other as from the eyes and situated well above a line drawn through centers of eyes; clypeus three times as long as wide, dark brown, smooth, shining, extending for half its length below inferior margins of genæ.

Pronotum convex, brown, punctate, pubescent; median carina obsolete; humeral angles strong, blunt, triangular. Scutellum entirely exposed and elevated in a flattened crest with the posterior apex produced in a hairlike spine. No posterior process.

Tegmina smoky-hyaline; veins strong and brown; clavus acuminate; tips rounded; five apical and two discoidal cells. Wings with four apical cells.

Sides of thorax, legs and undersurface of body uniform dark brown. Legs simple.

Type: female. Locality: Tena, Ecuador.

Described from a single specimen. Type in author's collection.

Campylocentrus nigris sp. nov. (Fig. 7)

Large, black, shining, punctate, sparingly pubescent; suprahumeral broad, sharp, extending outward and upward; base of posterior process slightly elevated above scutellum, inferior node touching tip of scutellum; tip of posterior process extending beyond internal angles of tegmina; tegmina black, hardly translucent, a subhyaline spot near base and another near internal apical margin; undersurface and legs black.

Head subtriangular, black, punctate, pubescent; base arcuate; eyes large, white; ocelli large, white, prominent, a little farther from each other than from the eyes and situated above a line drawn through centers of eyes; clypeus twice as long as wide, extending for half its length below inferior margins of genæ, tip rounded, pilose.

Pronotum black, punctate, sparsely pubescent; metopidium quadrate, about half as high as wide, smooth callosity above each eye; median carina percurrent; humeral angles large, triangular, prominent; suprahumeral horns strong, tricarinate, extending outward and upward with tips curving backward, a little longer than the distance between their bases; posterior process long, sinuate, gradually acuminate, tricarinate, base slightly elevated above scutellum, inferior node impinging on scutellum, tip sharp, extending beyond internal angles of tegmina and about to tip of abdomen; scutellum largely exposed, base tomentose, tip bifurcate.

Tegmina black, a subhyaline spot near base and another near internal apical margin; clavus obtuse; veins strong; five apical and two discoidal cells; apical limbus broad. Wings with four apical cells.

Sides of thorax tomentose; undersurface of body black; femora and tibiae black; tarsi ferruginous.

Length from front of head to tips of tegmina 8.5 mm.; width between tips of suprahumeral 5 mm.

Type: male. Locality: Costa Rica.

Described from two specimens, male and female, from the same locality. The female is entirely similar to the male in size, coloration and structure of pronotum. Type and allotype in author's collection.

Flexocentrus brunneus sp. nov. (Fig. 8)

Small, brown, punctate, pubescent; suprahumeral horns very short, extending directly outward; posterior process just reaching internal margins of tegmina; basal third of tegmina coriaceous and punctate, apical two-thirds hyaline; apical cells oblique, median apical cell sessile; scutellum well exposed; tibiae foliaceous.

Head wider than long, brown, punctate, pubescent; base sinuate; eyes large, brown; ocelli prominent, glassy, farther from each other than from the eyes and situated well above a line drawn through centers of eyes; clypeus broad, foliaceous, trilobed, continuing the outline of the inferior margins of the flattened genæ.

Pronotum brown, punctate, pubescent; metopidium convex, as wide as high, slightly tomentose; humeral angles strong, blunt, obtuse; suprahumeral horns very short, triquerate, flattened dorsally, about as long as the distance between their bases, extending directly outward, not projecting laterad as far as the humeral angles and no farther than the eyes; median carina percurrent; dorsum sinuate, a slight elevation just back of the suprahumeral; scutellum well exposed, slightly tomentose; posterior process long, slender, tectiform, tip acute and just reaching internal angles of tegmina.

Tegmina entirely exposed; clavus gradually acuminate from base to tip; corium with five apical and one discoidal cell; basal third coriaceous and punctate, apical two-thirds hyaline; apical cells oblique; median apical cell sessile; no limbus.

Sides of thorax slightly tomentose; undersurface of body brown; legs brown; tibiæ foliaceous; tarsi normal.

Length from front of head to tips of tegmina 5.9 mm.; width between tips of suprahumeral 2 mm.

Type: male.

Locality: Demerara River, British Guiana.

Described from a single specimen in author's collection.

***Leioscyta pulchella* sp. nov. (Fig. 9)**

Small, brilliant scarlet and black, finely punctate, sparsely pubescent; dorsum weakly sinuate; posterior process extending beyond tip of abdomen; tegmina hyaline with base black and punctate; eyes red, undersurface of body jet black; legs red.

Head longer than wide, black, very densely pubescent; base arcuate; eyes large, prominent, red; ocelli very small, inconspicuous, red, twice as far from each other as from the eyes and situated close to the basal margin of the head; clypeus foliaceous, quadrate, pubescent, tip rounded.

Pronotum finely punctate, sparingly pubescent, brilliant scarlet except lateral carinæ, tip of posterior process and depression above each humeral angle jet black; front margin convex above head, metopidium as high as wide; humeral angles prominent; median carina strongly percurrent; a strong lateral carina above shoulders on each side extending to lateral margins of pronotum; posterior process tectiform, tip black, extending beyond internal angles of tegmina and beyond abdomen; dorsum of pronotum very slightly sinuate in center.

Tegmina hyaline, base black and punctate; four apical and two discoidal cells; limbus broad.

Sides of thorax and undersurface of body black; legs red; first and second pairs of tibiæ broadly foliaceous.

Length from front of head to tips of tegmina 3.6 mm.; width between humeral angles 1.8 mm.

Type: male. Locality: Brazil.

Described from a single specimen in author's collection.

Erechtia trinotata sp. nov. (Fig. 10)

Black with three white spots, one on front of dorsal crest and two on median line of dorsum; dorsum nearly straight; pronotum punctate, sparingly pubescent; posterior process extending just beyond internal angles of tegmina; tegmina black, opaque, veins indistinct, four apical and three discoidal cells; two faint lateral carina on frontal crest; undersurface black.

Head foliaceous, black, punctate, pubescent; base nearly straight; eyes large, black, prominent; ocelli large, pearly, farther from each other than from the eyes and situated about on a line drawn through centers of eyes; clypeus broad, foliaceous, tip rounded.

Pronotum black, punctate, sparsely pubescent; anterior crest slightly porrect with two faint carina on each side; large white spot on median line of anterior crest and two other white spots on median line of dorsum; posterior process nearly straight, tectiform, tip acute and slightly decurved, extending just beyond internal angles of tegmina.

Tegmina black, coriaceous, base punctate; four apical and three discoidal cells; veins indistinct; apical limbus broad and wrinkled.

Sides of thorax, legs and undersurface of body entirely black; front and middle tibiae broadly foliaceous; posterior margins of hind tibiae serrate.

Length from front of head to tips of tegmina 5.9 mm.; width between humeral angles 2.1 mm.

Type: female.

Locality: Tucuman, Argentina.

Described from a single specimen received from Mr. Harold E. Box and dated December 31, 1927. Type in author's collection. We have a specimen from Jalapa, Mexico, which seems to agree in all particulars except that the eyes and abdomen are bright red and the tarsi flavous and we therefore hesitate to assign it to the same species without more knowledge as to distribution.

Orekthophora gen. nov.

Pronotum extended forward in a slender upcurved median horn; posterior process long, slender, reaching tips of tegmina, with a slight central inferior lobe; tegmina entirely free, coriaceous, five apical and three discoidal cells, terminal cell sessile; ocelli located in latero-basal angles of head; scutellum entirely hidden; legs simple; hind tarsi normal. Type *O. cornuta*.

Orekthophora cornuta sp. nov. (Fig. 11)

Small, black, punctate, pubescent; sides of thorax white tomentose; frontal horn long, slender, upcurved; posterior process reaching tips of tegmina; tegmina brown with white spots; undersurface black; femora and tibiae brown; tarsi white; claws brown.

Head subtriangular, longer than wide, black, punctate, with white tomentose patches; base sinuate; eyes large, prominent, gray; ocelli small, inconspicuous, amber-colored, very close to the eyes and to the basal margin of the head, far removed from each other; clypeus long, foliaceous, tip tridentate, extending for more than half its length below inferior margins of genæ.

Pronotum black, punctate, pubescent, sparingly tomentose; pronotal horn projecting forward and curving upward, somewhat flattened dorso-ventrally, tip distinctly bilobed; posterior process long, slender, decurved, tricarinate, undersurface showing a slight lobe at middle, tip sharp and reaching tips of tegmina.

Tegmina opaque, brown with white spots, base black and punctate; five apical and three discoidal cells; terminal cell not petiolate; apical limbus narrow.

Sides of thorax densely white tomentose; undersurface of abdomen black; femora and tibiae ferruginous brown; tarsi white; claws brown.

Length from front of head to tips of tegmina 5.5 mm.; length of pronotal horn 2.5 mm.; width between humeral angles 2.2 mm.

Type: female. Locality: San Domingo.

Described from two specimens, a male and a female. The allotype was collected at Blanton mine, north of Christobal, San Domingo, July 27, 1927, by Harold Morrison. Type and allotype in author's collection.

Spinodarnoides gen. nov.

Humeral angles produced in sharp spines; erect spine in center of dorsum; metopidium sloping; posterior process long, slender and reaching tip of abdomen; scutellum not exposed; third apical cell sessile, base truncate; legs simple; hind tarsi normal; tegmina hyaline, five apical and three discoidal cells. Type: *S. typus*. This genus is nearest *Paradarnoides* Fowler but differs in the spine-like humeral angles and the median spine on the dorsum.

Spinodarnoides typus sp. nov. (Fig. 12)

Long, slender, brown, punctate, pubescent, slightly tomentose; humeral angles produced in sharp spines; dorsum elevated in a triangular spine back of humerals; posterior process tricarinate, long, slender, extending almost to tip of abdomen; tegmina hyaline, five apical and three discoidal cells; abdomen brown with lateral margins yellow; legs flavous-brown.

Head twice as wide as long, brown, punctate, pubescent; frontal angle sharp; base sinuate; eyes large, yellow; ocelli large, prominent, yellow, more than twice as far from each other as from the eyes and situated about on a line drawn through centers of eyes; clypeus twice as long as wide, projecting for two-thirds its length below inferior margins of genæ.

Pronotum brown, punctate, pubescent, slightly tomentose; metopidium sloping, twice as wide as high; humeral angles produced in sharp spines; median carina percurrent; dorsum elevated in a strong triangular blunt spine just back of humeral angles; posterior process long, slender, straight, tip not reaching tips of tegmina nor tip of abdomen.

Tegmina entirely exposed, hyaline, base narrowly coriaceous and punctate; veins strong; five apical and three discoidal cells; median apical cell sessile, base truncate.

Sides of thorax tomentose; abdomen brown with lateral margin yellow; legs yellow-brown, simple.

Length from front of head to tips of tegmina 7.3 mm.; width between tips of humeral spines 3.5 mm.

Type: female. Locality: Porto Rico.

Type in author's collection.

***Alchisme projecta* sp. nov. (Fig. 13)**

Long, narrow, yellow, punctate; horns projecting strongly forward; dorsum elevated in an obtuse angle behind the humeral horns; posterior process extending beyond abdomen; median carina percurrent, concolorous; tegmina brown, coriaceous; undersurface and legs yellow; hind tarsi abbreviated.

Head three times as wide as long, yellow, punctate, roughly sculptured, sparingly pubescent; base strongly sinuate; eyes large, brown; ocelli large, yellow, much nearer to each other than to the eyes and situated about on a line drawn through centers of eyes; clypeus longer than wide, projecting for half its length below inferior margins of genæ.

Pronotum yellow, roughly punctate, sparsely pubescent; humeral angles produced into strong horns which project forward and upward, these horns sharp, triquerate, about as long as the distance between their bases; dorsum elevated in middle in an obtuse angle; posterior process long, slender, triquerate, tip sharp and extending to a point halfway between internal angles and tips of tegmina.

Tegmina dark brown, coriaceous, veins strong; apical limbus broad; five apical and two discoidal cells; terminal cell sessile.

Sides of thorax, legs and undersurface of body yellow; hind tarsi very short.

Length from front of head to tips of tegmina 9 mm.; width between tips of horns 5.7 mm.

Type: male. Locality: Peru.

Described from a single specimen in author's collection.

***Tragopa bitriangulata* sp. nov. (Fig. 14)**

Large, shield-shaped, yellow-brown with a large triangle definitely outlined in black on each side of metopidium and a dark brown fascia on each

side of pronotum behind middle; finely punctate, not pubescent; humeral angles auriculate; tegmina almost entirely covered by pronotum; under-surface and legs yellow-brown.

Head subquadrate, brown, punctate, roughly sculptured; base sinuate; eyes large, black; ocelli large, amber-colored, twice as far from each other as from the eyes and situated well above a line drawn through centers of eyes; clypeus longer than broad, extending for half its length below inferior margins of genæ, tip rounded, pilose.

Pronotum gray-brown, finely punctate; two large triangles strongly outlined in black on front of pronotum and a large brown fascia on each side behind middle; metopidium sloping, broader than high; median carina percurrent, brown; humeral angles large, prominent, expanded, auriculate; posterior process swollen, tip acute.

Tegmina almost entirely covered by pronotum; brown, coriaceous, veins indistinct; apical limbus broad; wings with four apical cells.

Legs and undersurface of body yellow-brown; legs simple.

Length from front of head to posterior tip of pronotum 4.8 mm.; width between tips of humeral angles 3.7 mm.

Type: female. Locality: Corumba, Matto Grosso, Brazil.

Described from a single specimen in author's collection.

Antonae bulbosa sp. nov. (Fig. 15)

Small, yellow and brown; six bulbs, one at base of each suprahumeral, one in center of dorsum, one on lateral margin at each side, one at base of posterior process; suprahumeral horns very short; posterior process with single terminal spine; tegmina entirely hyaline; legs yellow with joints black.

Head twice as wide as long, shining, yellow with brown striae, roughly sculptured; base arcuate; eyes very large, prominent, amber-colored, equidistant from each other and from the eyes and situated a little below a line drawn through centers of eyes; clypeus longer than wide, extending for half its length below inferior margins of genæ, tip rounded and pilose; genæ with a black spot below each eye.

Pronotum yellow and black, smooth, shining, not punctate, bearing a few scattered long black coarse hairs; anterior pronotum convex with a bulb at the base of each short suprahumeral horn, a second bulb behind horns and just before median constriction, a small bulb on each side on margin of pronotum below median bulb, a very large bulb at base of posterior process; posterior process ending in a single sharp median spine which extends beyond internal angles of tegmina; suprahumeral horns very short, blunt, extending directly outward; humeral angles small, blunt; dorsal surface of frontal and median lobes marked with brown; dorsal and lateral surfaces of posterior lobes brown; no median carina.

Tegmina entirely hyaline, entirely exposed; five apical and three discoidal cells; apical limbus broad.

Undersurface of body yellow; legs yellow with black joints.

Length from front of head to tips of tegmina 5 mm.; width between tips of suprahumeral horns 2 mm.

Type: male. Locality: Mexico.

Described from a single specimen in author's collection.

Poppea zebrina sp. nov. (Fig. 16)

Shining yellow with black markings, feebly punctate, not pubescent; pronotum bulbous, weakly depressed on sides before posterior expansion; suprahumeral horns short, sharp, jet black, extending directly outward; front of pronotum bearing four black parallel stripes; tip of posterior process trispinose; tegmina hyaline with veins of costal area black; undersurface and legs yellow.

Head subtriangular, smooth, shining, yellow, not punctate nor pubescent; base feebly arcuate; eyes large, white; ocelli large, white, nearer to each other than to the eyes and situated about on a line drawn through centers of eyes; genæ narrowly margined with black; clypeus diamond-shaped, its apex about continuing the line made by the inferior margins of genæ.

Pronotum swollen, shining yellow, very lightly punctate, not pubescent; four heavy black parallel lines extending over the metopidium between the horns and another line on each side below the horns; suprahumeral horns short, sharp, entirely black, extending directly outward, not as long as the distance between their bases; metopidium sloping; humeral angles reduced, blunt, not conspicuous; median carina obsolete; depression between anterior and posterior lobes of pronotum not deep; posterior process ending in three spines, the middle one three times as long as the lateral, tip of process extending just beyond internal angles of tegmina but not reaching tip of abdomen.

Tegmina hyaline, veins of costal area black; five apical and one discoidal cell; apical limbus broad.

Sides of thorax, undersurface of body, femora, tibiae and tarsi uniformly shining light yellow.

Length from front of head to tips of tegmina 7.2 mm.; width between tips of suprahumeral horns 4 mm.

Type: male. Locality: Barro Collo, Canal Zone.

Described from five specimens, all males, received from Mr. S. W. Frost and all collected by Mr. Frost at the type locality on February 11, 1929. Type and paratype in author's collection.

Poppea nitida sp. nov. (Fig. 17)

Large, shining purplish-brown, finely punctate, not pubescent; suprahumeral horns long, sharp, extending upward and outward with tips curving backward; dorsum feebly sinuate, slightly swollen behind suprahumeral horns; posterior process trispinose, lateral spines swollen at bases, terminal spine

slender and decurved; tegmina smoky-hyaline; undersurface dark brown; legs yellow. This species is close to *P. subrugosa* Fowler but is very much larger and differently marked.

Head twice as wide as long, dark purplish-brown, shining, not punctate, not pubescent, roughly sculptured; base arcuate; eyes large, gray; ocelli large, prominent, yellow, equidistant from each other and from the eyes and situated about on a line drawn through centers of eyes; clypeus twice as long as wide, extending for two-thirds its length below inferior margins of genæ, yellow, marked with two longitudinal brown striæ, tips acute.

Pronotum shining dark purplish-brown, lightly punctate, not pubescent; metopidium straight, about as broad as long; humeral angles prominent, triangular; median carina faintly percurrent; suprahumeral horns long, strong, sharp, extending outward and upward with tips curving backward; dorsum weakly sinuate, slightly swollen behind suprahumeral horns; posterior process heavy, trispinose, lateral spines swollen at bases, terminal spine long, slender, decurved, extending far beyond internal angles of tegmina.

Tegmina smoky hyaline, veins prominent, five apical and three discoidal cells; apical limbus broad.

Undersurface of body brown; legs yellow.

Length from front of head to tips of tegmina 10 mm.; width between tips of suprahumeral 5.2 mm.

Type: male. Locality: Aqualane, Peru.

Described from a single specimen. Type in author's collection.

Maturna maculata sp. nov. (Fig. 18)

Small, green, punctate, not pubescent; front of head, metopidium and basal half of tegmen black; pronotum highest in front of humeral angles; dorsum feebly sinuate; posterior process extending just beyond tips of tegmina; sides of pronotum longitudinally ridged; tegmina half covered by pronotum, five apical and one discoidal cell; sides of thorax black; abdomen black; legs yellow.

Head wider than long, black, punctate, rough; base sinuate; eyes large, brown; ocelli large, brown, equidistant from each other and from the eyes and situated about on a line drawn through centers of eyes; clypeus wider than long, apex about continuing line of inferior margins of genæ.

Pronotum green except metopidium which is black; punctate; front roughly sculptured; four longitudinal ridges behind humerals; metopidium perpendicular, highest in front of humeral angles, triangular; humeral angles large, prominent, triangular; median carina strongly percurrent; dorsum weakly sinuate; posterior process tectiform, tip sharp and extending slightly beyond tips of tegmina.

Tegmina half covered by pronotum; basal half black and punctate, apical half hyaline; veins strong; five apical and one discoidal cell; median apical cell petiolate; apical limbus narrow.

Sides of thorax black; abdomen black; legs yellow; tibiae simple; tarsi normal.

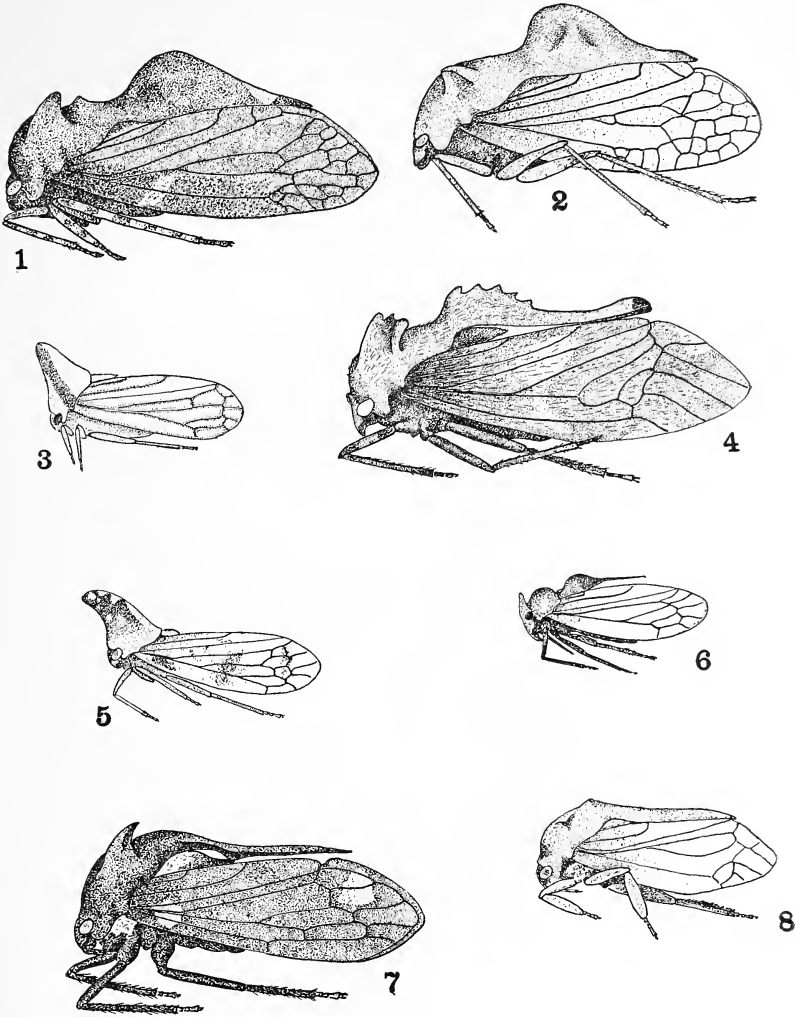
Length from front of head to tips of tegmina 5.1 mm.; width between humeral angles 2 mm.

Type: male. Locality: Canon del Tolima, Colombia.

Described from two males from the same locality. Type and paratype in author's collection.

PLATE XXII

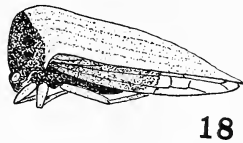
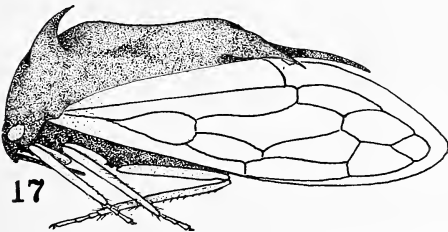
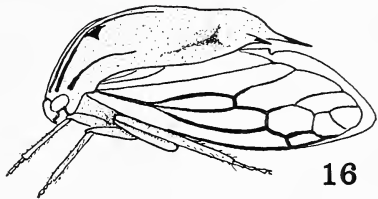
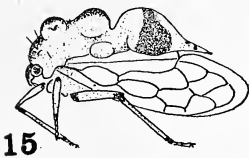
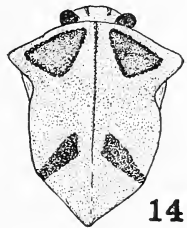
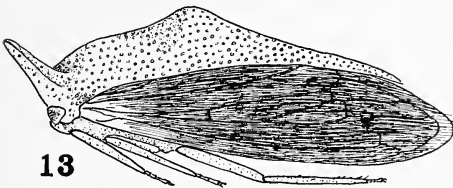
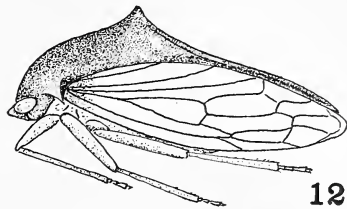
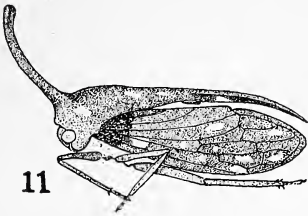
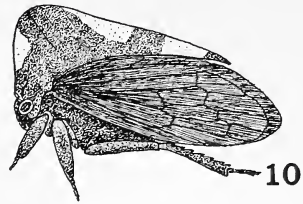
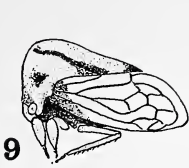
- Figure 1. *Centronodus denticulus* sp. nov.
- Figure 2. *Centronodus flavus* sp. nov.
- Figure 3. *Orekthen osborni* sp. nov.
- Figure 4. *Dontonodus serraticornis* sp. nov.
- Figure 5. *Eustollia variegata* sp. nov.
- Figure 6. *Mina spinosa* sp. nov.
- Figure 7. *Campylocentrus nigris* sp. nov.
- Figure 8. *Flexocentrus brunneus* sp. nov.



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PLATE XXIII

- Figure 9. *Leioscyta pulchella* sp. nov.
Figure 10. *Erechtia trinotata* sp. nov.
Figure 11. *Orektophora cornuta* sp. nov.
Figure 12. *Spinodarnoides typus* sp. nov.
Figure 13. *Alchisme projecta* sp. nov.
Figure 14. *Tragopa bitriangulata* sp. nov.
Figure 15. *Antonæ bulbosa* sp. nov.
Figure 16. *Poppea zebrina* sp. nov.
Figure 17. *Poppea nitida* sp. nov.
Figure 18. *Maturna maculata* sp. nov.



MEMBRACIDÆ

THE EXTERNAL MORPHOLOGY OF THE MEXICAN
BEAN BEETLE, *EPILACHNA CORRUPTA* MULS.
(COCCINELLIDÆ, COLEOPTERA)¹

BY HARVEY L. SWEETMAN

The Coccinellidæ are very important from an economic standpoint, largely because of their predaceous habit. One tribe, the Epilachnini, feeds upon plants and two species, *Epilachna corrupta* Muls. and *E. borealis* (Fab.), are pests in the United States. From a taxonomic viewpoint the Coccinellidæ are very difficult to classify because of their size and uniformity of appearance. Perhaps a detailed study of the external morphology of one species, *E. corrupta* Muls., will suggest the use of some structures of taxonomic value, that are not made use of at present.

The writer wishes to express his appreciation to Dr. G. C. Crampton for the many helpful suggestions he has offered during the progress of this study and to Mr. C. O. Eddy of the South Carolina Agricultural Experiment Station and Mr. R. Cecil of the New York Agricultural Experiment Station for the furnishing of preserved specimens.

GENERAL DESCRIPTION

The bean beetle is about one-fourth of an inch long and one-fifth of an inch wide. The general body color varies from a light yellow to brown, depending on age and somewhat on environmental conditions. The elytron is usually marked with eight black spots as follows: three near the base, three near the center forming a transverse row, and two near the apex. The entire external surface of the body is clothed with minute setæ giving the beetles a pubescent appearance. In the following study no mention is made of setæ unless they are of a different appearance from the pubescence mentioned above.

¹ This paper was submitted to the faculty of the Graduate School of Massachusetts Agricultural College as part of a thesis in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

LITERATURE

Studies in the morphology of certain families of the Coleoptera include the following: Hayes (1922) and Friend (1929) on the Scarabaeidæ, Korschelt (1923) on the Dystiscidæ, Van Zwaluwenburg (1922) on the Elateridæ, and Rivnay (1928) on the Chrysomelidæ. Those who have worked on special structures of the Order include Forbes (1922, 6) and Graham (1922) on the wings; Stickney (1923) on the head capsule; Tanner (1927), Wilson (1926, 7), Sharp and Muir (1912), and Muir (1918) on the genitalia. Works on the general morphology that have proved of value in this study include the text by MacGillivray (1923), and the numerous papers of Snodgrass and Crampton, especially the latter.

THE HEAD

Head Capsule. The head capsule of the Mexican bean beetle is somewhat elliptical in shape, being broader than long. It is composed of several united sclerites, those found on the more primitive Coleoptera having fused so that all of the sutures have nearly or entirely disappeared. The epicranial suture has disappeared on the dorsal surface (Fig. 2). It is doubtful if any portion of the arms of this suture remain. Stickney (1923) found a trace of the epicranial arms ventro-cephalad of the compound eyes (e) in two species of Coccinellidæ, *Hippodamia convergens* Guer. and *Adalia bipunctata* (L). The dorsal surface of the epicranium cannot be divided accurately into the recognized areas because of the absence of ridges and sutures. The position of the frontal pits (fp) cephalad of the compound eyes is indicated in the figure although the depressions are rather obscure. The labrum (lr) is attached to the head capsule by a membrane which may be the anteclypeus. The antennifer (anf) is prominent and serves as a pivot for the scape (ac) of the antenna. The ventral aspect of the head is shown in Figure 1. The raised area between the gular sutures (gs) is the gula (gl). The sutures extend only a short distance cephalad from the magnum foramen (mt), where they lead into the distinct gular pits (gp). Extending cephalad from the magnum foramen and

laterad of the gular sutures are prominent folds which are associated with a change in level of the gula from the surrounding areas. The anterior portion of the gular region is not demarked laterally. The hypostoma (h) to which the mandibles (md) and maxilla (mx) are attached is sharply defined.

The tentorium has two parts each extending from the frontal (fp) to the gular (gp) pits. One of these is shown in Figure 3. The pits are the external manifestations of the invaginations of the head capsule to form the internal processes of the tentorium. The body of the tentorium has apparently disappeared leaving only the anterior (at) and posterior (pt) arms. A remnant of the dorsal arm (dt) is indicated by a small protuberance at the point of junction of the anterior and posterior arms. The anterior arm shows a slight thickening near the frontal pit, but the posterior arm is greatly enlarged in the gular region (gl). The cephalic extension of the posterior arm is a very delicately sclerotized rod that is difficult to dissect out without breaking. Apparently the fusing of sclerites and loss of sutures of the head capsule has been accompanied by a reduction in size and rigidity of the tentorium until it is nothing more than two delicate rods.

The eyes (e) are very prominent organs about twice as long as broad. They are located on the cephalo-lateral margins of the head and can be seen from both the dorsal and ventral aspects of it. The ocular sclerites are found on the inside periphery of the eyes. There are no ocelli.

The antennæ (Fig. 2), composed of eleven segments each, are meso-cephalad of the eyes. The bulb (b, Fig. 5) of the scape (ac) fits into the antennal socket (as). It is slightly enlarged but does not form a distinct ball like that in the more primitive Coleoptera such as the Meloidæ. The scape is the longest segment of the antenna. The pedicel (pd) is narrower and shorter than the scape, but is broader than the first six segments of the flagellum (fu). The first segment of the latter is slightly longer than the pedicel while the remaining eight segments are shorter. Segments two to six are short and stout. The three terminal segments are greatly broadened, largely on one side, forming a rather distinct club.

Mouthparts. The labrum (Fig. 9) is composed of two parts which may be called antelabrum (lr) and postlabrum (pl) for convenience, although the region designated postlabrum may be the anteclypeus or a fusion of the two structures. Stickney (1923) states that the preclypeus (anteclypeus) is always present and is usually membranous. The labrum is attached to the head capsule by a membrane between the dorsal surface of the postlabrum and the clypeal region. This membrane is termed the preclypeus by Stickney. The antelabrum, the only part of the labrum showing externally, is covered with numerous prominent setæ that project beyond the anterior margin.

The epipharynx (ep, Fig. 4), lining the under side of the labrum, forms the roof of the mouth and extends caudad under the clypeal region. It is membranous in structure and has minute ridges arranged over a bell shaped area indicated by the dotted lines in Figure 4. These ridges are densely setose, while the remaining portion is smooth or sparsely covered with hairs.

The hypopharynx (hp, Fig. 4), a flat, rounded lobe much smaller than the epipharynx, is attached mainly to the dorsal side of the labium. The cephalic margin is covered with a very dense mass of slender hairs. The dorsal surface is thickly clothed with minute setæ, while the ventral region is more sparsely covered with similar setæ. Several slender bristles are also found on the ventral surface. The pharyngeal cavity opens between the hypopharynx and epipharynx.

The mandibles (md) have their mesal margins covered by the labrum (lr, Fig. 2). The incisor region is well developed and bears three sharp teeth (Fig. 12). These regions of the two mandibles overlap, increasing the efficiency when cutting plant tissues. They articulate with the head capsule at two points, a dorso-lateral one where a protuberance of the latero-clypeal region fits into the ginglymus of the mandible and a ventro-lateral one where the condyle (c) of the mandible fits into the acetabulum of the postgenal region. The basal sclerite (bc) has apparently fused so firmly with the mandible that only a small projection not demarked by a suture remains. A ventro-mesal membranous lobe, the submola (sa), on the basal portion of the

mandible bears a dense fringe of setæ on its mesal margin. Scattered setæ are present on the basal half of the mandible.

The maxilla is shown in Figure 11. The cardo (cd) contains a deep groove on its basal edge by which it articulates with the hypostoma (h, Fig. 1). An internal projection, the cardo process (cp), extends into the head capsule and serves for muscle attachment. The next division of the maxilla, the stipes (st), is composed of two triangular sclerites (Crampton, 1923). The palpifer (pfr) situated dorsad of the basal sclerite of the stipes is a hollow cylinder bearing the four segmented palpus (mp). The fourth segment of the palpus is the longest, followed by the second, third, and first in the order given. Each segment, beginning with the basal end, is wider than the preceding one. The fourth segment is flattened and membranous on the distal end and probably contains sensory organs on this area. The galea is composed of two segments, the basigalea (bb) and the distigalea (da). The former is sclerotized on its dorsal surface and membranous on its ventral surface. It is attached to the distal end of the stipes. The lacinia (la), a pear-shaped sclerite from the ventral aspect, is attached to the stipes also. The distal ends of the lacinia and the distigalea are covered with dense brushes of hairs that often are worn short in old specimens. The maxilla is covered with many minute setæ but is devoid of spines or teeth.

The true labium is attached to the head capsule between the maxillæ by the mentum and submentum, sclerites which are generally included as a part of the labium, but strictly speaking are not a part of it (Crampton, 1928). The subdivisions of the labium (Fig. 10) are submentum, mentum, united palpigers, united paraglossæ, and palpi. The submentum (sm) is a heavily sclerotized sclerite firmly attached to the gular region of the head capsule. The mentum (mn) is movably attached to the submentum. The distal third, to which are attached the united palpigers, is membranous while the basal portion is heavily sclerotized. The palpigers (np) have become united (Crampton, 1928) forming a thick, fleshy structure rather heavily sclerotized which bears the palpi. The palpi (lp) are composed

of three segments, the first very short, the second longest, with the third slightly shorter than the second and tapering to a point at the distal end. The paraglossæ (ds) have become fused also and form the distal lobe of the fleshy stalk made up of the united palpigera. A longitudinal groove marks the line of union of the two palpigera and the two paraglossæ. The entire structure is densely covered with very minute setæ. The glossæ have become fused with the paraglossæ or have been lost.

THORAX

Cervical sclerites. The lateral cervicalia (lc, Fig. 6) appear as dumb-bell shaped sclerites in the intersegmental membrane between the prothorax and head capsule. The cephalic end is more enlarged than the caudal end. There is a faint trace of a suture through the median portion of the cervicalia.

Prothorax. The pronotum (pn, Figs. 6, 7, 8) comprises a single sclerite which is about three times as long as broad from the dorsal aspect. The latero-cephalic margins are extended forward along the sides of the head. The pronotum extends ventrad to the precoxal bridge (pc) cephalad of the coxæ (cx) and to the furcasternum (fs) caudad of the coxæ. A lateral carina is formed at the line of folding between the dorsal and ventral surface. This does not take the place of a suture as has been shown by Crampton (1926). The ventral portion of the pronotum probably overlaps the pleuron and fuses with it.

The basisternum (bs, Figs. 6, 7) is broad anteriorly and very much reduced between the coxæ (cx). The anterolateral branches of the basisternum are the precoxalia (pc) which unite with the pronotum. A suture separates the precoxalia from the pronotum. The furcasternum (fs) is between and behind the coxæ. The lateral extensions uniting with the pronotum form the postcoxal bridges (pcx) closing the coxal cavities posteriorly. The furcal pits (fp) are very shallow slits produced by invaginations forming the furcæ (f). The furcæ are internal projections of the body wall extending dorsad and serving for muscle attachment. The trochantin (tn, Fig. 24) is a small pleural sclerite that has been drawn internally with the basal portion of the coxæ (cx). It is movably attached to the coxæ and to the body wall by a membrane.

The leg is shown in figure 27. The coxa (ex, Figs. 6, 7, 24, 27) extends into the body cavity, the basal third not being visible externally. It is about three times as long as broad in its widest part and rotates antero-posteriorly in the coxal cavity. The dorsal surface is open for about two-thirds of its length for the entrance of muscles and other internal structures. On one side near the apex of the coxa is a cavity which receives the condyle of the trochanter (tr). The latter is a somewhat triangular shaped segment articulating distally with the femur (fr) and basally with the coxa. The movement between the trochanter and femur is very much restricted. The flexor surface is indented to receive the distal end of the tibia when the leg is folded. The femur is the largest segment of the leg and is about three times as long as broad. It tapers somewhat at the ends and is deeply and broadly grooved on its flexor surface to receive the tibia. The distal end contains a cavity for the reception of the condyle of the tibia. The tibia (ti) is about as long as the femur and about two-thirds as wide. It is elbowed at the basal end which permits it to fit into the groove of the femur when the leg is folded. There are two spurs (sb) on the flexor surface at the distal end. The articulation with the femur permits more freedom of movement of the tibia than is found with the other divisions of the leg. The dorsal surface is deeply hollowed for reception of the tarsus when the leg is folded. The tarsus (ta) is distinctly four segmented as with many of the Coccinellidæ. The so-called apparently three-segmented tarsus is a character used in many keys to separate this from the other Coleopterous families. Since beginning students can easily see the four segments in many species it is very misleading to speak of the Coccinellidæ as having apparently three segmented tarsi. The first segment is conical, being narrow at the point of articulation with the tibia and is broadened and cut off obliquely at the distal end. It is densely pubescent beneath. The second segment is flat and triangular in shape, being broadened distally. The distal third is densely pubescent beneath. An opening is present on the dorsal surface just before the middle for reception of the third segment. The latter is very short and cylindrical in shape. It articulates with the second but is immovably attached to the

fourth segment. The fourth segment is conical and curved, the distal portion being the largest. This is the longest segment of the tarsus. Distally it bears two bifid claws, which are longer than the third segment.

Mesothorax. The mesothorax is the smallest of the three thoracic segments. The notum (Figs. 13, 14) can be divided into three areas: the prescutum (psc), scutum (sc), and scutellum (sl). The cephalic margin of the prescutum is V-shaped, the extensions of the arms forming the suralares (su). The scutum is the area between the prescutum and scutellum. Both the scutum and prescutum lie beneath the caudal margin of the pronotum. The scutellum is the triangular elevated area mesad of the bases of the elytra. It is the only exposed portion of the notum when the elytra are in place. The parascutellum (pas) is beneath the scutellum and extends laterad under the bases of the elytra. A groove is formed between the scutellum and parascutellum along the lateral margins of the former for the reception of the antero-mesal margins of the elytra when at rest. With the exception of the scutellum, which is hidden by the parascutellum, the internal aspect of the above structures are shown in figure 14. The phragma (pf) is an invagination of the notum serving for muscle attachment.

The mesothoracic axillary sclerites (ax, Fig. 13) are greatly modified from those found in the primitive Coleoptera so that it is impossible to homologize the sclerites until a thorough study of intermediate forms has been made.

The mesopleuron (Figs. 17, 19) is made up of two sclerites, the episternum (es) and epimeron (em). The pleural suture (ps), which is the external manifestation of the pleural ridge (pr), demarks the episternum and epimeron. A longitudinal carina, shown as a dotted line, divides the epimeron into two areas. The epimeron is united with the episternum along the pleural suture, the other sides being free, which permits free access of air to the metathoracic spiracle (ms) that lies beneath it. The alifer (o), a dorsal process of the episternum, gives support to the elytron. The pleural ridge is formed by the infolding of the posterior margin of the episternum and the anterior margin of the epimeron. It is quite broad dorsally and

tapers so that it is much narrower ventrally. The pleural apodeme (pa) is a projection of the dorsal portion of the pleural ridge extending meso-ventrally. There is no trochantin.

The basisternum (bs, Figs. 17, 19) extending in front of and between the coxæ (cx) comprises the greater portion of the mesosternum. The portions in front of the coxæ are the precoxalia (pc). In the mesal region is a pit (pe) in which the prominent portion of the prothoracic basisternum between the coxæ fits. Just behind the pit is a transverse suture dividing the basisternum into two sclerites. Projecting laterad from the pit are distinct carinæ, shown by the dotted lines, which extend into the episternum. The furcasternum (fs) shows externally as a narrow transverse area behind the furcal pits (fp) and coxæ. The pits are the external manifestations of the furcæ (f). When the coxæ are removed the inflexed portions of the furcasternum under them can be seen. The areas behind the coxæ are the precoxalia (pcx). Internally between the furcæ is a sclerotized rod (sr) connecting these inflexed parts of the coxal cavities. The mesothoracic spiracle (msp, Fig. 6) is in the intersegmental membrane connecting the prothorax and mesothorax.

The mesothoracic leg (Fig. 26) is slightly larger but otherwise similar to the prothoracic leg except for the coxa. The coxa (cx) is broader than long and is reduced in movement in its articulation with the body.

The elytron (Fig. 22) is a heavily sclerotized convex structure completely covering one-half of the abdomen. Two main tracheæ (to) with numerous fine branches extend nearly to its tip. The longitudinal margins are inflexed, the lateral one being much more so and greatly thickened. This margin is flattened ventrally so that it can fit snugly against the surface to which the beetle is clinging. It likewise fits closely against the latero-ventral angle along the thorax and abdomen. These margins are hollow and contain body fluids which probably are carried throughout the elytron indicating that the internal tissues are alive. The portion of the elytron serving for attachment to the notum is called the apophysis (ap). The eight, prominent black spots on the elytron referred to in the general description are not shown in the figure.

Metathorax. The metathorax is the largest of the thoracic segments. The notum (Figs. 15, 16) can be divided into four areas: the prescutum (psc), scutum (sc), scutellum (sl), and postscutellum (psl). The prescutum is an arched sclerite narrowed in the middle and broadened laterally. Its posterior margin blends with a semimembranous region connecting it with the scutum. The anterior margin projects into the body cavity forming the prephragma (pph). A membrane connects it with the mesothorax. The scutum (sc) is the largest of the notal areas. It is divided longitudinally by a median groove (mg) which is carried on through the scutellar region. The thickened mesal inflexed portions of the elytra fit into this groove. A large lobe demarked by a suture is evident on each half of the scutum. This arched lobe probably strengthens the body wall and the suture is the external manifestation of invaginations of the body wall serving for muscle attachment. The three lateral projections of the scutum associated with the wing are the suralare (su), adnotale (ad), and adanale (pw). A small muscle disk (m) is in the membrane anterior to the suralare. Three of the axillary sclerites: the notale (n), basanale (ba), and one of the medialia are readily distinguished. The scutellum (sl) is formed of two triangular shaped sclerites and the portion of the median groove dividing them. The post-scutellum (psl) is composed of a narrow transverse sclerite connected to the scutellum by a membranous area. Its posterior margin projects into the body cavity forming the postphragma (po). Lateral prolongations, the postalar bridges (pb), connect the postscutellum with the anepimera (aem, Figs. 18, 20).

The metapleuron (Figs. 18, 20) is divided into two areas, the episternum and epimeron. The pleural suture (ps), which becomes indistinct dorsally, separates the two regions. Internally the pleural ridge (pr) is prominent. The episternum is divided into the katépisternum (kes), which connects the pleuron to the sternum, the anépisternum (aes), and the pre-episternum (pes). About half of the pre-episternum lies beneath the anépisternum. The basalar region (bt) has apparently fused with the anépisternum. The epimeron is subdivided into the katépimeron (kem) and anépimeron (aem). The dorsal portion

of the anepimeron is membranous except at the anterior and posterior margins. A prolongation of the anterior portion forms the alifer (o) for supporting the wing while the posterior margin connects with the postalar bridge (pb). A muscle disk (m) is in the membranous region. The trochantin has disappeared.

The metasternum (Figs. 18, 20) is flat and smooth and is larger than the prosternum and mesosternum. The basisternum (bs) is divided longitudinally by a median suture (mu) and transversely by another suture into anterior and posterior regions. The anterior region is inflexed at the mesothoracic coxal cavities. A sclerotized rod (sr) connects these inflexed areas. An indistinct suture separates the mesosternum and metasternum along the inflexed walls of the coxal cavities and the rod connecting them. The furcasternum (fs) consists of a small median sclerite anterior to and between the coxæ and a narrow transverse sclerite in front of each coxa. A median suture (mu) divides it longitudinally. Internally the furcasternum bears the furca (f), a broad, flat piece with six projections. The median suture divides the furca also.

The metathoracic leg (Fig. 25) is about the size of the mesothoracic leg. It differs from the other legs in the shape and the attachment of the coxa (cx). The coxa is attached along its anterior margin and ends so as to give it a restricted hinge-like movement (Figs. 18, 20). It is flattened and tapers at both ends and has the anterior half of the dorsal surface opening into the body cavity. A large muscle disk is attached at the antero-mesal angle of the coxa.

The wing (Fig. 23) is membranous and has a much reduced and peculiar venation. Since Forbes (1922) has made a detailed study of the wings of Coleoptera his interpretations will be followed. The venation is seen clearly in the basal half of the wing only and all of the veins have migrated forward. The subcostal (Sc) and the radial (R) veins are near the costal margin. Probably the basal portion of the subcosta is present forming a small loop with both ends coalesced with the radius. The radius is greatly modified and is so broken up that the parts are difficult to identify. The media is present as a recurrent vein (Mr) and the branch M_2 , which coalesces with the cubitus (Cu). The

anals (A) show a peculiar looping and portions of the three anals may be present.

The folding of the wing of the bean beetle follows the peculiar venation (Fig. 23). The areas concerned in the folding are numbered from one to five. The positions where the folds occur are shown as solid lines that are lettered from *a* to *n*. Dotted lines are used to indicate variations in the places of folding. By viewing the extended wing from the dorsal aspect the folding can be explained as follows: Area 1 folds under at the oblique line *ab* and lies flat against the ventral surface of the wing. Area 2 folds over onto area 4 at the transverse line *cde*. Area 3 folds over onto area 4 at the longitudinal line *dfng*. Area 4 folds under at the transverse line *hmfl* carrying area 2 with it until area 4 comes into contact with the ventral surface of the wing. A secondary folds occurs at *mn*. Area 5 tends to fold over on the line *kj*, but the point *g* is approximately above the line *kj* when the wing is folded. The areas 2 to 5 are folded more or less simultaneously; the areas 2, 3, and 5 folding approximately at the same time, with area 4 slightly delayed. The folded wing forms a loose mass that permits ample room for wrinkles produced by the angles of the folds.

ABDOMEN

Eight abdominal tergites are visible when the wings are spread (t, Figs. 30, 31). Probably at least two more are represented by the hidden genital segments (Figs. 32-34). The tergites are not definitely demarked from the pleurites. The first tergite (1t) is semimembranous in texture with the exception of two transverse sclerotized areas near the posterior margin. Tergites two to seven (2t-7t) are rather flexible in texture and become membranous between the segments. A wider membranous area lies between tergites two and three and three and four. A similar area exists in the median region between tergites four and five. The seventh tergite has a small membranous area in the postero-medial region. The eighth tergite (8t) is more heavily sclerotized than the others. Internally the appearance of the tergites is only slightly changed (Fig. 31). A slight invagination at the junction of the tergites is evident. Projections into

the body cavity occur laterally between tergites six and seven and seven and eight.

Seven visible pleurites (1p-7p) are present (Figs. 28, 29). The eighth pleurite may be present as a connecting membrane between the tergite and sternite. Externally (Fig. 29) deep folds of the pleurites occur but when the muscle attachments are removed (Fig. 28) they appear as a smooth membrane.

The abdomen has seven spiracles (1sp-7sp, Figs. 28, 29). The first is about three times the size of the second but it is much smaller than the first spiracle of the more primitive Coleoptera and is round instead of elliptical in shape as is found in the generalized forms. The second to the fifth are similar in size, but the sixth and seventh are greatly reduced, appearing as mere specks. Minute tracheæ lead to the sixth and seventh which are still apparently functional. Balsam mounts of the pleuron showed very small openings in a few of these spiracles when examined through the compound microscope.

There are seven visible sternites (2s-8s), the first having fused with the second or else disappeared (Figs. 21, 28, 29). They are heavily sclerotized with the exception of sternite two. This forms the ventral connection of the abdomen with the thorax and is largely membranous except along the posterior margin. The greater portion of this sternite is invisible when the abdomen is in a normal position. The third is the largest of the sternites. It is inflexed along the anterior margin on either side to form the posterior portion of the metathoracic coxal cavities. The mesal part projects cephalad between the mesal ends of the metacoxæ. Posterior to the coxal cavities are the metacoxal plates (ma) demarked by an indistinct suture and ridge. The plates are subdivisions of sternite three (3s). They are usually narrower in the ♂. The posterior margins of sternites four to six in the ♀ (4s-6s, Fig. 29) and three to six in the ♂ (3s-6s, Fig. 21) are sharply demarked, smooth, and more or less transparent. The areas are wider in the ♂ and can be used to distinguish the sexes. Sternite eight (8s, Fig. 21) of the ♂ is notched in the mesal portion of the posterior margin. Often-times this notch is hidden by the pubescence on the sternite.

Tanner (1927) has published an excellent paper on the ♀ genitalia of the Coleoptera and Crampton (1929) has made a comparative study of the ♀ genitalia throughout the orders of insects. The ♀ genitalia (Figs. 28-31, 35, 37) are retracted within the eighth segment. Dorsally there are two sclerites, the proctiger (pi) and surstylus (pp). The latter extends over the pleural region to the ventral side. The coxites (co) form the ventral part of the genitalia. Near the ventro-mesal margins of these are deep grooves with sharp lips. The dorsal lip of one coxite fits into the lips of the other coxite so that they interlock. Each coxite bears a stylus (ss) posteriorly, which articulates with the coxite in a membranous area. Wilson (1926) states that the genital tubercle (stylus) is absent. The posterior margins of the surstylus, proctiger, coxites, and styli bear numerous setæ. The anal opening (a) is situated above the genital orifice (g).

The terminal segments of the ♂ are shown from three aspects in Figures 32, 33, and 34. At least parts of the ninth and tenth segments can be distinguished. They are retracted into the eighth segment except during copulation. The anal orifice (a) is situated above the genital opening (g).

The ♂ genital tube in the Coleoptera has been studied comprehensively by Sharp and Muir (1912) and by Muir (1918). Wilson (1926, 7) has published on the genital tube of the Coccinellidae. He has followed the terminology of the former workers. The genital tube (Fig. 36) lies inside the body cavity and is turned on its side. It is quite different from that of the other families of the Coleoptera. The entire structure with the exception of the ejaculatory duct and the enclosing membrane is heavily sclerotized. The ejaculatory duct (ed) leads from the seminal vesicles into a hollow, curved tube, the median lobe (ml). The latter is flattened and slightly expanded at the base and does not form a complete tube in this portion. The median lobe passes through a supporting structure, the tegmen (tg). The tegmen is composed of the basal piece (bp), basal lobe (bl), lateral lobes (ll), and the median strut (mc). The basal piece is the central portion supporting the other structures. The lateral

lobes are outgrowths of the tegmen clothed with setae on the distal half. The basal lobe (Wilson, 1926) surrounds the median lobe and has its edges touching but does not form a solid tube. The median strut is an outgrowth of the basal piece in the direction of the base of the median lobe. A sclerotized rod (sr) attached to the basal piece of the tegmen by muscles is probably of a supporting nature and may aid in turning the genital tube when the latter is extruded. A delicate enclosing membrane, not shown in the figure, covers the genital tube and is attached to the genital segments.

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ABBREVIATIONS ON FIGURES

a, Anal orifice	gl, Gula
A, Anal veins	gp, Gular pits
ac, Antennal scape	gs, Gular suture
ad, Adnotale	h, Hypostoma
aem, Anepimeron	hp, Hypopharynx
aes, Anepisternum	kem, Katepimeron
anf, Antennifer	kes, Katepisternum
ap, Apophysis	l, Labium
as, Antennal socket	la, Lacinia
at, Anterior arms	lc, Lateral cervicales
ax, Axillary sclerites	ll, Lateral lobes
b, Bulb	lp, Labial palpus
ba, Basanale	lr, Labrum, antelabrum
bb, Basigalea	m, Muscle disk
bc, Basal sclerite	M, Media
bl, Basal lobe	ma, Metacoxal plate
bs, Basisternum	me, Median strut
bp, Basal piece	md, Mandible
bt, Basalar region	me, Mediale
c, Condyle	mg, Median groove
cc, Coxal cavity	ml, Median lobe
cd, Cardo	mn, Mentum
cl, Claw	mo, Median orifice
co, Coxite	mp, Maxillary palpus
cp, Cardo process	Mr, Median recurrent vein
Cu, Cubitus	ms, Metathoracic spiracle
ex, Coxa	msp, Mesothoracic spiracle
da, Distigalea	mt, Magnum foramen
ds, United paraglossae	mu, Median suture

dt, Dorsal arm	mx, Maxilla
e, Eye	n, Notale
ed, Ejaculatory duct	np, United palpigera
em, Epimeron	o, Alifer
ep, Epipharynx	p, Pleurite
es, Episternum	pa, Pleural apodeme
f, Furca	pas, Parascutellum
fp, Furcal pit	pb, Postalar bridge
fr, Femur	pc, Precoxale
frp, Frontal pit	pex, Postcoxale
fs, Furcasternum	pd, Pedicel
fu, Flagellum	pe, Pit
g, Genital orifice	pes, Pre-episternum
pf, Phragma	sa, Submola
pfr, Palpifer	sb, Spur
pgr, Palpiger	sc, Scutum
ph, Pharynx	Sc, Subcosta
pi, Proetiger	sl, Scutellum
pl, Postlabrum	sm, Submentum
pn, Pronotum	sp, Spiracle
po, Postphragma	sr, Sclerotized rod
pp, Surstylus	ss, Stylus
pph, Prephragma	st, Stipes
pr, Pleural ridge	su, Suralare
ps, Pleural suture	t, Tergite
pse, Prescutum	ta, Tarsus
psl, Postscutellum	tg, Tegmen
pt, Posterior arm	ti, Tibia
pw, Adanale	tu, Trochantin
R, Radius	to, Tracheae
s, Sternite	tr, Trochanter

PLATE XXIV

- Figure 1. Ventral aspect of head.
- Figure 2. Dorsal aspect of head.
- Figure 3. Lateral aspect of one-half of tentorium.
- Figure 4. Ventral aspect of pharynx, hypopharynx, and epipharynx.
- Figure 5. Antenna.

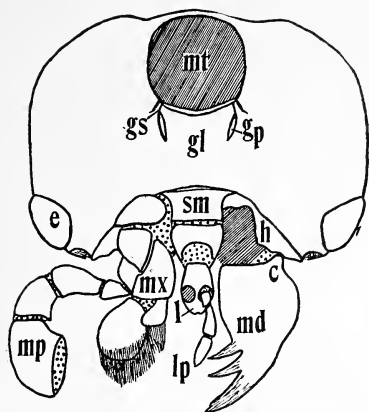


Fig. 1

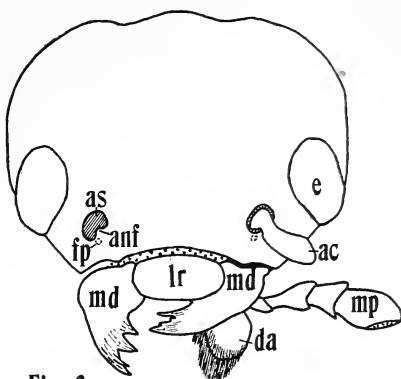


Fig. 2

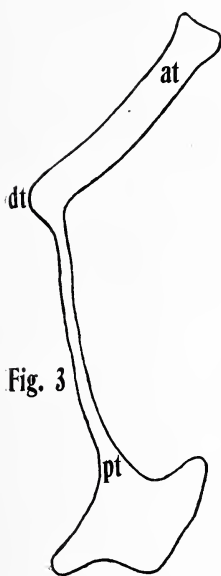


Fig. 3

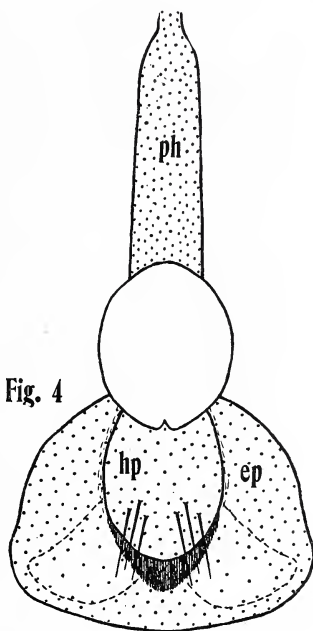


Fig. 4

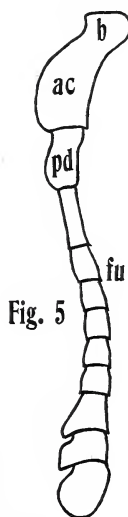


Fig. 5

EPILACHNA CORRUPTA

PLATE XXV

- Figure 6. Ventral aspect of prothorax.
Figure 7. Posterior aspect of prothorax.
Figure 8. Dorsal aspect of pronotum.
Figure 9. Labrum.
Figure 10. Labium.
Figure 11. Maxilla.
Figure 12. Mandible.

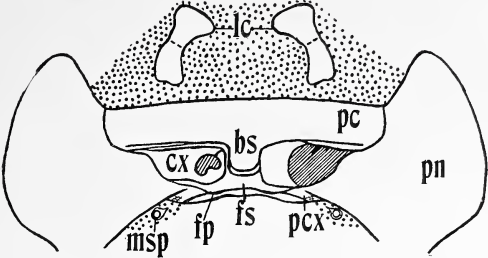


Fig. 6

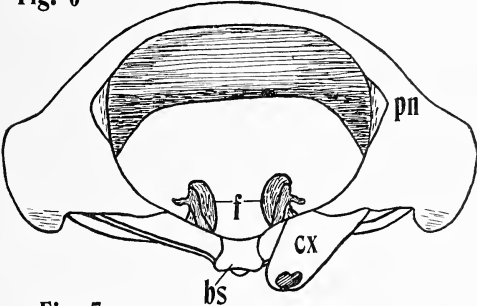


Fig. 7

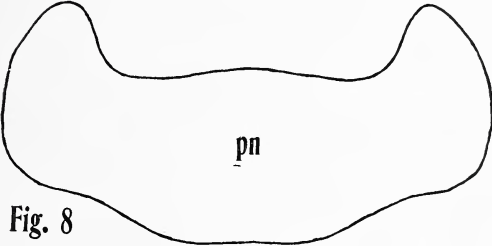


Fig. 8

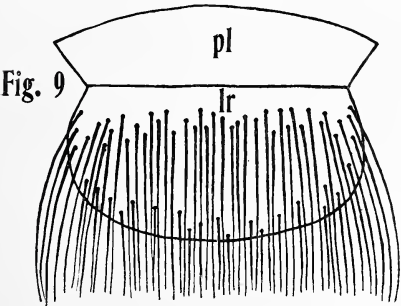


Fig. 9

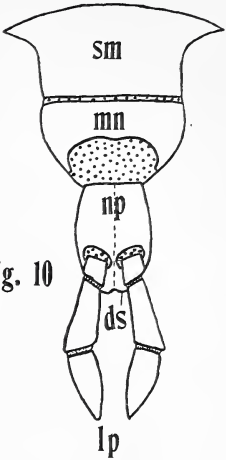


Fig. 10

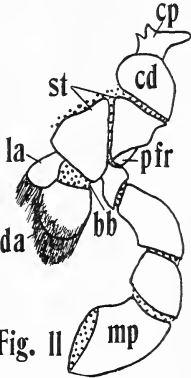


Fig. 11

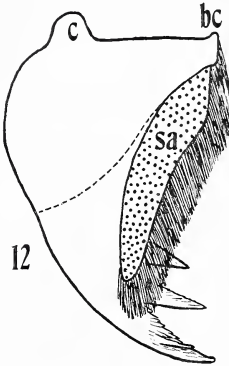


Fig. 12

PLATE XXVI

- Figure 13. External aspect of mesonotum.
Figure 14. Internal aspect of mesonotum.
Figure 15. External aspect of metanotum.
Figure 16. Internal aspect of metanotum.

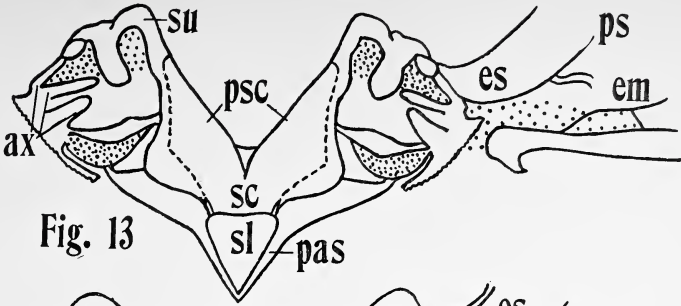


Fig. 13

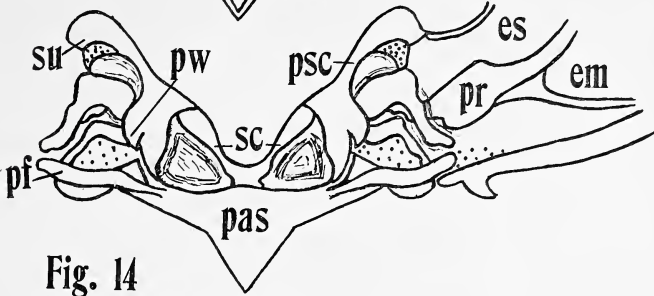


Fig. 14

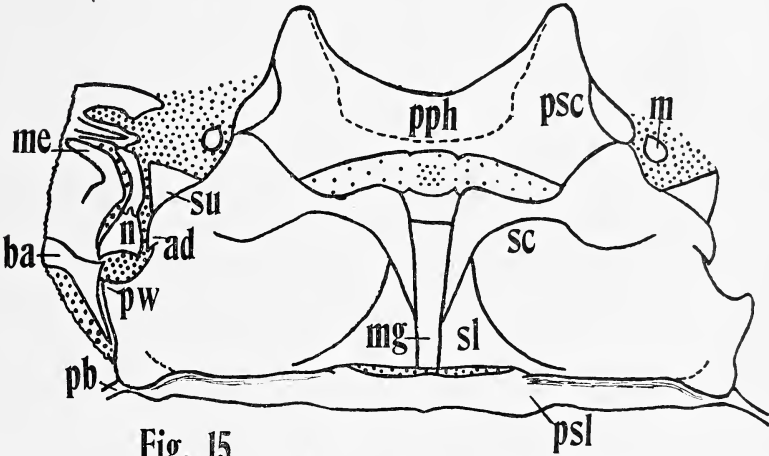


Fig. 15

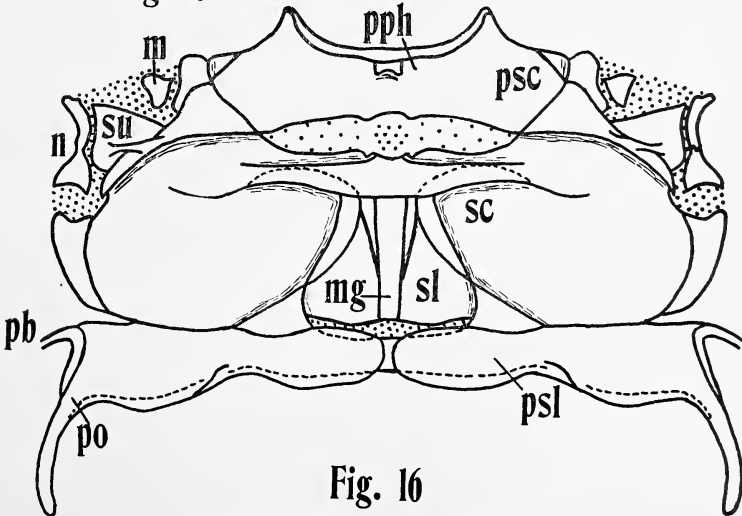


Fig. 16

PLATE XXVII

- Figure 17. Internal aspect of mesosternum and mesopleuron.
Figure 18. Internal aspect of metasternum and metapleuron.
Figure 19. External aspect of mesosternum and mesopleuron.
Figure 20. External aspect of metasternum and metapleuron.

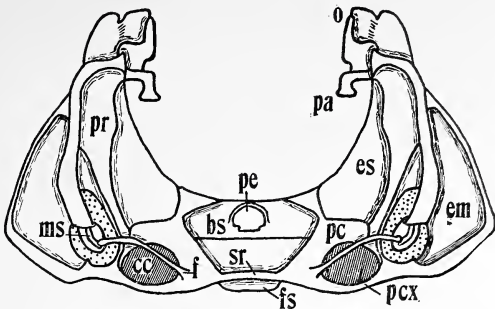


Fig. 17

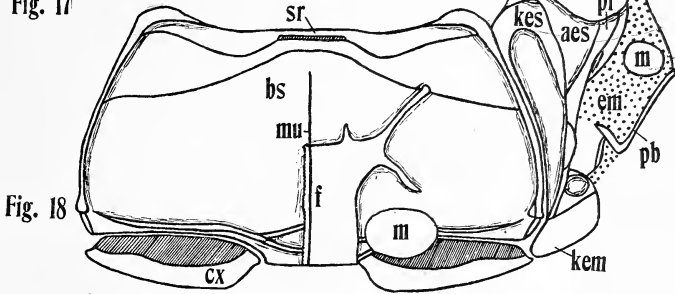


Fig. 18

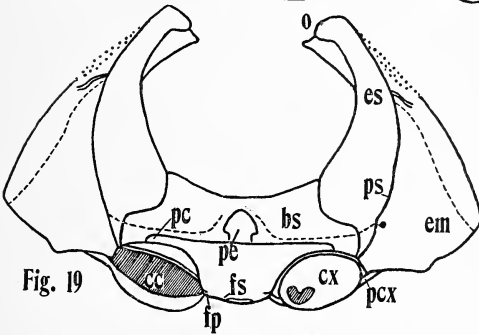


Fig. 19

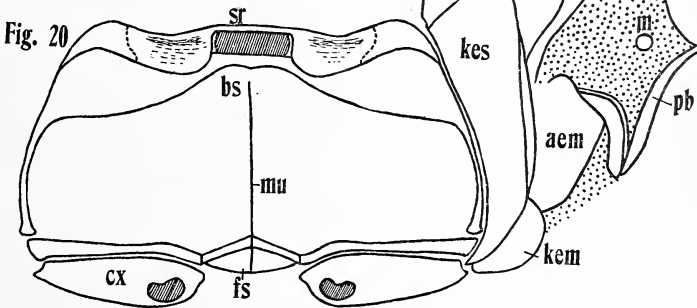


Fig. 20

EPILACHNA CORRUPTA

PLATE XXVIII

- Figure 21. External aspect of ♂ sternites.
- Figure 22. Elytron.
- Figure 23. Wing.
- Figure 24. Prothoracic coxa and trochantin.
- Figure 25. Metathoracic leg.
- Figure 26. Mesothoracic leg.
- Figure 27. Prothoracic leg.

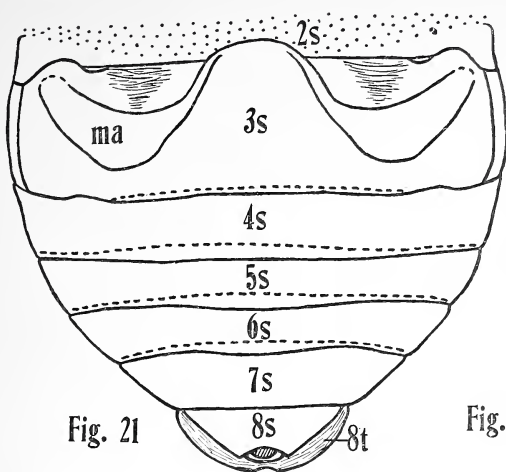


Fig. 21

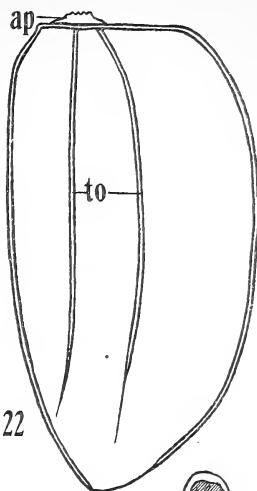


Fig. 22

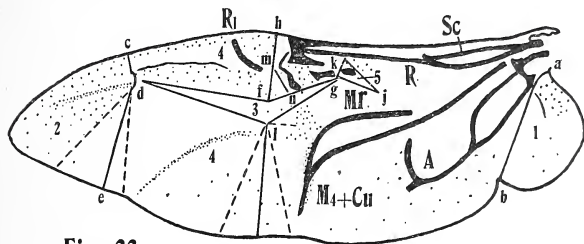


Fig. 23



Fig. 24

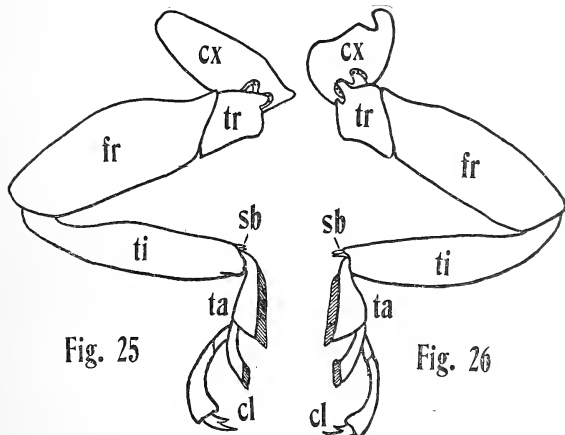


Fig. 25

Fig. 26

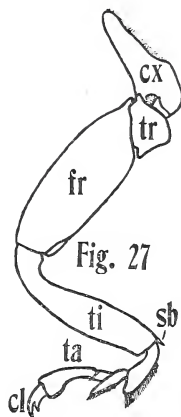


Fig. 27

PLATE XXIX

Figure 28. Internal aspect of ♀ sternites.

Figure 29. External aspect of ♀ sternites.

Figure 30. External aspect of ♀ tergites.

Figure 31. Internal aspect of ♀ tergites.

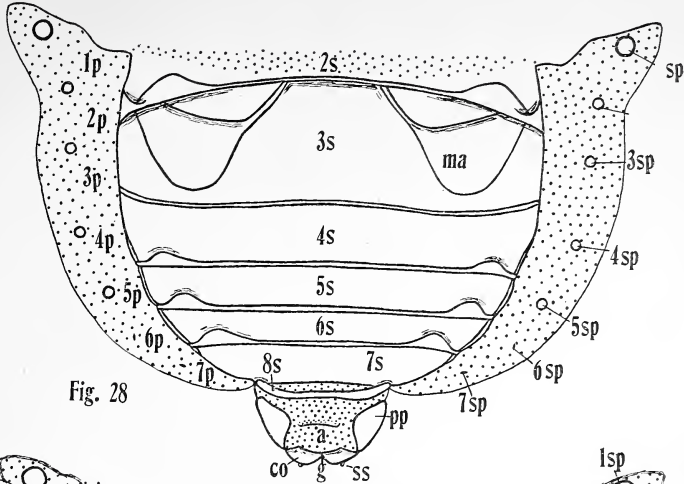


Fig. 28

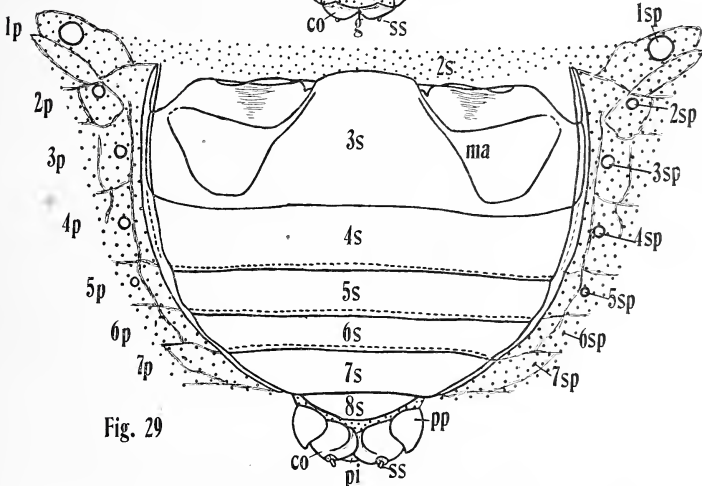


Fig. 29

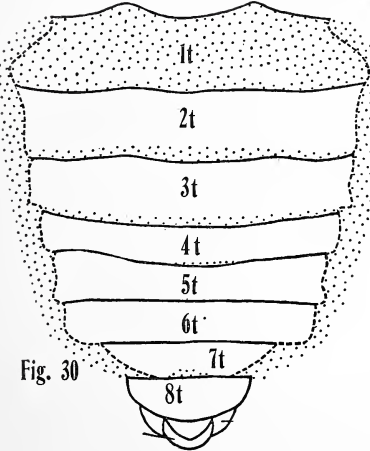


Fig. 30

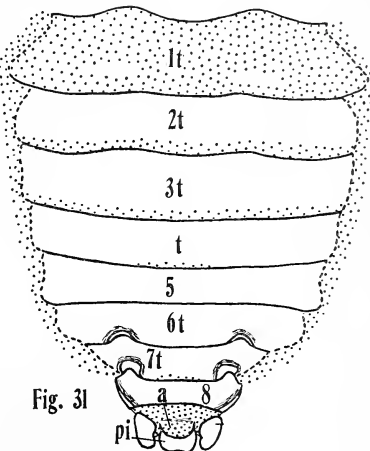
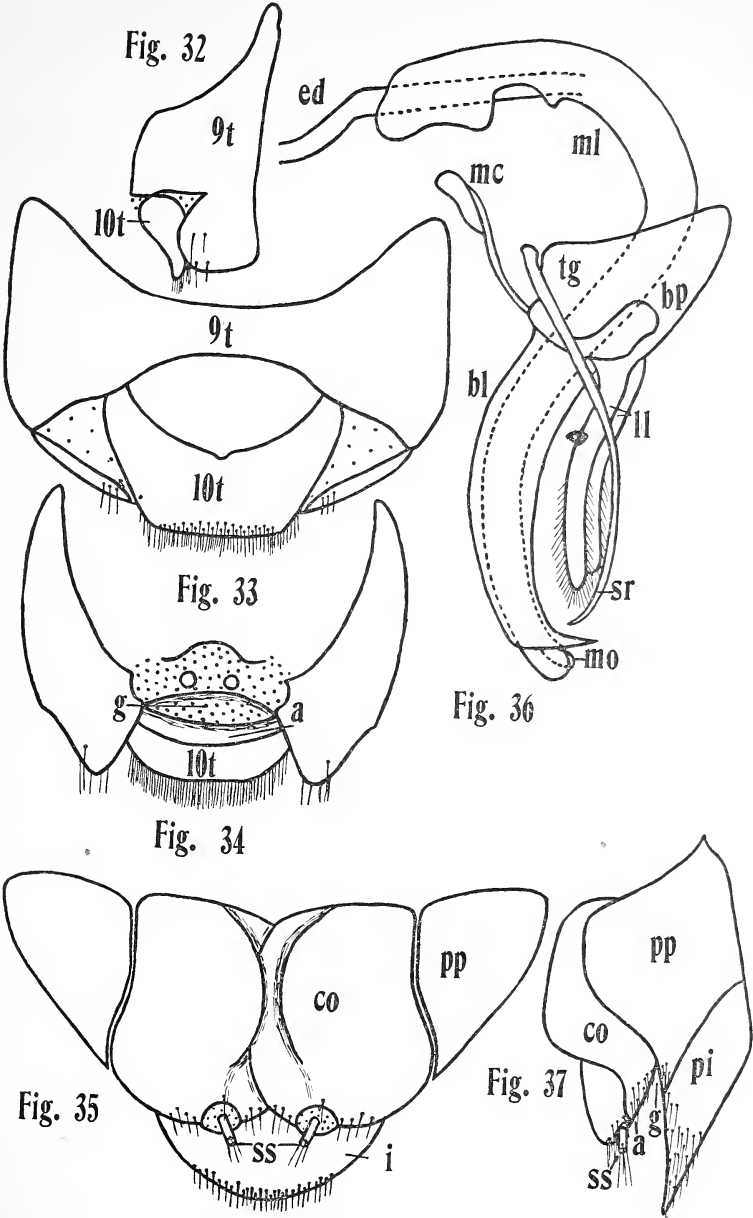


Fig. 31

EPILACHNA CORRUPTA

PLATE XXX

- Figure 32. Lateral aspect of ♂ genitalia.
Figure 33. Dorsal aspect of ♂ genitalia.
Figure 34. Ventral aspect of ♂ genitalia.
Figure 35. Ventral aspect of ♀ genitalia.
Figure 36. ♂ genital tube.
Figure 37. Lateral aspect of ♀ genitalia.



EPILACHNA CORRUPTA

DESCRIPTIONS OF NEW SOUTH AMERICAN HESPERIIDÆ (LEPIDOPTERA, RHOPALOCERA)

BY E. L. BELL

FLUSHING, N. Y.

Niconiades reducta new species. (Fig. 1, male genitalia. Type.)

MALE. Upperside. Primaries, brown, six semi-hyaline spots, yellowish, as follows: two discal spots, one each in interspaces 2 and 3, excised on their outer edge; two small spots in the cell, one above the other, a little beyond the center; two minute sub-apical spots in interspaces 6 and 7. Secondaries; same color as primaries, very faint indications of a row of discal spots; a tuft of long brown hairs from the base of the cell, extending to about the center of the wing; inner edge also long-haired.

Beneath. Primaries, brown, paler than above; from vein 2 to inner margin paler than the rest of the wings; a blackish patch from the spot in interspace 2 to the base of the wing; spots of the upper-side repeated. Secondaries, brown, a minute yellowish spot in the cell-end; a band of four discal spots, the lowest much larger than the others, yellowish.

Fringes, fuscous above and beneath. Body; above, thorax, greenish; abdomen, brownish with some green hairs at the base; beneath; thorax with sordid greenish hairs; abdomen, white with a dark line in the center. Legs, brown, striped with yellowish beneath. Head and palpi; above green with a few yellow hairs; beneath, palpi with fuscous and scattered yellowish-white hairs, at the sides fulvous; pectus yellowish-green. Antennae, above, black beneath the upper part of the shaft with the joints minutely marked with yellowish; club and apiculus, yellow with a few dark scales. Stigma reduced to two small round spots, black, one below and touching vein 2 a little beyond its angle, the other directly beneath it on vein I.

Expanse: 42 mm.

Type. Holotype, male, French Guiana; in collection of the author.

The species may not belong in this genus, but from the rather elongate secondaries and general superficial appearance, it will probably be as readily recognized here as any where.

Cobalus cristatus new species. (Fig. 2, male genitalia. Type.)

MALE. Upperside. Primaries, dark brown, with a slight luster; a minute vertical, semi-hyaline streak in interspace 3, about one-third of the distance from the base of the interspace. Secondaries, same color as the primaries; a short, thick tuft of hairs, darker than the ground color of the wing, from

the base of the cell, prominently noticeable; inner margin of the abdominal fold also long haired. Fringes of the primaries fuscous, paler at the tip; of secondaries, whitish.

Beneath. Primaries, cell blackish; costal margin and apical half, somewhat reddish; below vein 2 to inner margin much lighter, almost whitish, but not quite reaching the outer margin; the streak of the upper side repeated and another rather ill-defined streak in interspace 2, about the center. Secondaries, purplish brown, abdominal fold brown. Fringes fuscous.

Body. Above, thorax, green; abdomen, black; beneath, thorax, greenish; abdomen, whitish. Head and palpi, above green, beneath, palpi fuscous and yellow; pectus green. Legs, black above, fulvous beneath. Antennae, above black; beneath, shaft narrowly yellow in the upper two-thirds; club and apiculus yellow. No visible stigma.

Expanse: 34 mm.

Type. Holotype, male, Hansa Humboldt, Santa Catharina, Brazil; in collection of the author.

The form of the valvae resembles that of some of the *Rhithon* species, but the characteristic stigma of that genus is lacking.

Euroto fuldai new species. (Fig. 3, male genitalia. Type.)

MALE. Upperside. Primaries, blackish-brown; two white-hyaline spots in the cell, a little beyond the center; a semi-hyaline, pale yellowish spot on vein I, a little beyond the center and about half the width of the interspace; a small semi-hyaline white spot above the outer corner of the spot just mentioned in interspace I; a large, subquadrate, hyaline, white spot in interspace 2; another smaller one in interspace 3; three sub-apical, white spots, the central one placed inwardly out of line with the other two, the lower two hyaline, the upper spot very small; fulvous scales on the basal half of the costa; greenish-yellow hairs on the basal half of the inner margin. Secondaries, same color as the primaries; a discal band of six, elongate, pale yellowish spots, the upper four of which are better defined than the other two; some greenish-yellow hairs along the edge of the abdominal fold and over the cell. Fringes of primaries fuscous; of secondaries, whitish.

Beneath. Primaries, costal margin at extreme base violaceous, from there to the cell-end overscaled with pale yellowish; apical area and outer margin to vein 2, violaceous with the veins outlined with pale yellow; rest of the wing, black; spots of the upper side repeated; those in interspace I enlarged, coalescent and white. Secondaries, steely, violaceous blue, all of the veins heavily outlined with pale yellow, abdominal fold violaceous-brown; spots of upperside repeated, white, with another spot between the cell-end and the upper angle of the wing, and another in the cell-end. Fringes, of primaries paler than above and darkened at the end of the veins, sordid whitish at the anal angle; of the secondaries, whitish.

Body. Thorax, above with yellowish-brown hairs; abdomen, black; beneath, thorax white; abdomen yellow. Legs yellow, thighs with white hairs. Head and palpi, above yellow and black; beneath, palpi whitish. Antennae missing.

Stigma, a triangular patch filling the angle at the rise of vein 2, slightly longer on the median vein than on vein 2; a stripe immediately below vein 2.

Expanse: 32 mm.

Type. Holotype, male, Simiti, Colombia, July 2, 1929; in collection of the author.

Named for Mr. Oscar Fulda, of New York City, who collected the specimen.

Mnasitheus badius new species. (Fig. 4, male genitalia. Type.)

MALE. Upperside. Primaries, brown, immaculate. Secondaries, same as the primaries. Fringes of both wings brown, paler at the anal angle of each wing.

Beneath. Primaries, brown, paler than above, from vein 2 to inner margin paler than the rest of the wing. Secondaries, darker than the primaries, with a somewhat reddish tinge, except the abdominal fold which is pale brown.

Body. Thorax and abdomen, above and beneath brown. Head and palpi, above brown; palpi beneath brown, with some of the hairs pale tipped. Legs brown. Antennae missing.

The stigma consists of an indistinct narrow line on the underside of vein 2, near its base; a slightly heavier line beneath it on vein I, also indistinct.

Expanse: 36 mm.

Type. Holotype, male, Santa Cruz, Bolivia; in collection of the author.

Prenes vala race *immaculata* new race.

MALE. Upperside, differs from *vala* Mabille in the primaries being devoid of the discal, cellular and sub-apical spots.

Beneath, the primaries have a faint suggestion of these spots; the streak in interspace I, which is white in *vala*, is in this form pale brown. Secondaries, the curved discal band of spots and the cellular spot are also faint. The ground color of the secondaries is darker than typical *vala*.

The fringes, the palpi and abdomen beneath, are darker than in *vala*.

The form of the genitalia is identically the same as the Biologia Centrali-Americana figure of the genitalia of *vala* (Plate 96, figure 18).

Type. Holotype, male, Blumenau, Santa Catharina, Brazil, March; paratype, male, Manicore, Brazil, August; in collection of the author.

These specimens have been unidentified in the collection of the author for several years, and as they present so different an appearance superficially from *vala*, that it would hardly be suspected that they were in reality so closely allied to that species, it seems fitting to distinguish the race by a special designation in order to call attention to the fact of its existence.

Phlebodes simplex new species. (Fig. 5, male genitalia. Paratype.)

MALE. Upperside. Primaries, dark brown, a few paler scales indicate discal spots in interspaces 2 and 3, and sub-apical spots in 6, 7, and 8, all of these are very faint. Secondaries, immaculate, dark brown.

Beneath. Primaries, dark brown, a little paler than above; spots of upperside repeated a little more distinctly. Secondaries, basal half of the wing violaceous brown, this area bordered outwardly from the abdominal-fold to the costal margin by a semi-circular row of pale spots; a small pale spot in the cell-end; all the rest of the wing is dark brown.

Body. Thorax and abdomen, above and beneath, and legs, dark brown. Head and palpi, above and beneath, dark brown. Antennae, above black, beneath, shaft black, club and apiculus brownish-yellow.

The stigma consists of a somewhat triangular part near the base of interspace 2, the longest side on the median vein, reaching about the middle of that segment, a small roundish piece just below vein 2, and a narrow streak extending upward from vein I, near its center, slanting outward to the outer edge of the small spot below vein 2.

Expanse: 32 mm.

Type. Holotype, male, Blumenau, Santa Catharina, Brazil, November; paratype, male, Mubevo, Paraguay, December; in collection of the author.

This may not belong in the Genus *Phlebodes*, but it seems to fit here better than elsewhere.

Vorates steinbachi new species. (Fig. 6, male genitalia. Type.)

MALE. Upperside. Primaries, blackish brown, basal two-thirds of the costal margin sprinkled with orange-yellow scales; a short ill-defined stripe of the same color in the base of the cell, on the median vein; another similar one in the upper part of the cell, near the end; an oblique discal row of similarly colored, narrow and uneven spots in cells I, 2, 3, and 4; and four sub-apical spots, of the same color, those in interspaces 5, 6, and 7 placed in an outwardly, very slanting row, the fourth, in interspace 8 placed out of line towards the apex. Secondaries, same color as primaries; discal area and inner edge of abdominal fold with fulvous hairs; a collection of pale fulvous scales just beyond the end of the cell, noticeable but not forming a defined spot. Fringes of primaries fuscous above vein 2, from there to

anal angle orange-yellow; of secondaries, fuscous with some orange-yellow scales intermixed. Beneath. Primaries, black, a yellow line from the base to the apex, just inside the coastal edge; a yellow streak in the center of the cell; another in the upper part of the cell, near the end; the discal and sub-apical spots of the upper side are repeated, except that in interspace I is absent; the outer margin narrowly yellow from the apex to vein 2, and this color is extended along veins 3, 4, 5, 6, 7, and 8. Secondaries, blackish-brown, all of the veins heavily outlined with yellow. Fringes as above.

Body; thorax and abdomen blackish-brown above, with some fulvous scales; beneath sordid yellowish, abdomen with a dark central line; pectus greenish-yellow. Head and palpi, above black and yellow, palpi beneath, yellow and dark brown. Legs, brown above; fulvous beneath. Antennæ, above black; beneath, yellow at the joints, club and apiculus yellow. The stigma consists of an angular part between veins 2 and 3, a narrow stripe along the median to the rise of vein 3, and a shorter stripe on the upper side of vein 2; another stripe immediately below vein 2.

Expanse: 30 mm.

Type. Holotype, male, Cochabamba, Bolivia, in collection of the author.

Named for Mr. Jose Steinbach, of Santa Cruz, Bolivia.

Mnaseas inca new species. (Fig. 7, valve of male genitalia. Type.)

MALE. Upperside. Primaries, brownish, becoming almost black basally; scattered yellowish-brown scales in the apical area and along the outer margin to vein 2; a hazy spot in the lower cell-end and one each in interspaces 2, 3, 4, 5, 6, and 7, forming a bent row around the cell-end, all yellowish-brown and ill-defined. Secondaries, same color as primaries and dark at the base. Fringes of both wings pale brown with a dark line at the base.

Beneath. Primaries, paler than above, with a ferruginous tinge, blackish toward the base below the cell; discal and sub-apical spots of the upper side repeated, and one more in interspace 8, all yellowish and brighter than above; the spot in the cell absent. Secondaries, ferruginous; a curved band of pale and ill-defined spots in the disc. Fringes as above, but the dark basal line is not so pronounced.

Body; thorax above brownish with some yellow scales, abdomen brownish; beneath ferruginous. Head and palpi, above brown mixed with yellow, palpi beneath, yellowish-white mixed with black, at the sides ferruginous. Antennæ missing. The stigma is a narrow gray line slanting inwardly across interspace 2 from near the rise of vein 3, and continued very indistinctly across interspace I to vein I.

Expanse: 30 mm.

Type. Holotype, male, Santa Cruz, Bolivia, in collection of the author.

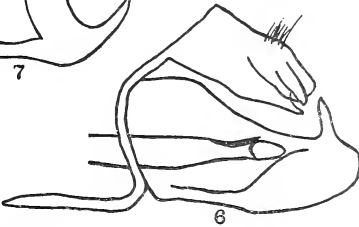
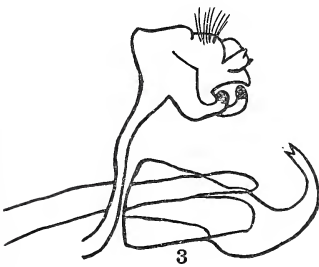
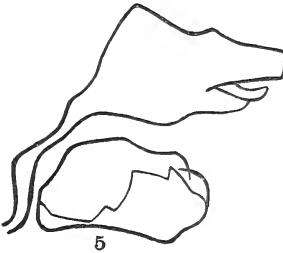
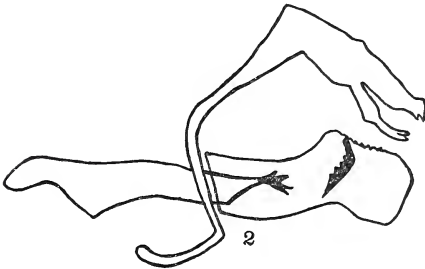
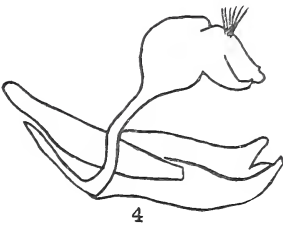
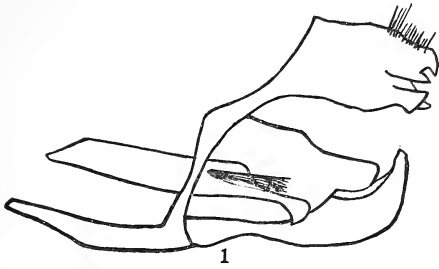
Unfortunately the genitalia were broken in preparation, and only the valve is figured; the form is very similar to that of *bicolor* Mabille. It may be a race of *bicolor*.

All measurements of expanse are from the center of the thorax to the apex $\times 2$.

PLATE XXXI

Male genitalia

- Figure 1. *Niconiades reducta* Bell. Type.
- Figure 2. *Cobalus cristatus* Bell. Type.
- Figure 3. *Euroto fuldai* Bell. Type.
- Figure 4. *Mnasitheus badius* Bell. Type.
- Figure 5. *Phlebodes simplex* Bell. Paratype.
- Figure 6. *Vorates steinbachi* Bell. Type.
- Figure 7. *Mnaseas inca* Bell. Type.



HESPERIIDÆ

INSECTS FROM LACTUCA STEMS*

BY ETHEL LOUISE SHAW

This is a study of the insect population found in the stalks of *Lactuca spicata* (Lam.) Hitchc., of the family Compositæ. The plants used were collected from three small open woodlands near Ithaca, N. Y. The plants were growing on the banks of small streams or on slightly marshy ground on a hillside.

This plant is well adapted for supporting a large insect population within its stalks. From the base up to a height of two or three feet the stem is almost entirely hollow, but from this point on up to the apex the pith increases in thickness until, when the flower panicle is reached, the center of the stalk is almost completely filled. The most abundant insect population was found where the pith was from 1/4 to 3/16 inches thick.

The material used in this study consisted of the stalks of the previous season. These were brought indoors, some being examined immediately to determine what stages in the life history of the various insects were present at that time; others were kept in a warm room for the purpose of rearing adults.

NOTES ON INSECTS FOUND¹*Hemiptera*

This order was represented by a single adult *Brachymena quadripustulata*, family Pentatomidae, which was found dead within the hollow stalk of a plant collected on March 13.

* The work was done at Cornell University under the direction of Dr. James G. Needham during the late winter and spring of 1930.

¹ Acknowledgment is made to the following specialists for their aid in the determination of the insects found:

Lepidoptera

Dr. W. T. M. Forbes and Mr. A. B. Klots, Cornell University.

Diptera

Dr. O. A. Johannsen, Cornell University.

Hymenoptera

Dr. L. H. Weld and Dr. A. B. Gahan, U. S. Bureau of Entomology, Washington, D. C.

Dr. J. C. Bradley and Mr. V. S. L. Pate, Cornell University.

Coleoptera

One adult beetle was found free-ranging in the hollow *Lactuca* stem. It was a minute, shining black, convex insect belonging to the family Phalacridæ, whose members are said to live in flowers and under the bark of trees.

Lepidoptera

The commonest caterpillar found was *Phalonia bunteana* which is a borer in the stalks of a number of herbaceous plants. The larvæ found were in shallow depressions about $\frac{3}{8}$ of an inch long, hollowed out of the pith and roofed over with a covering of silk and frass. In one case three larvæ were found in one stem. All others were in separate stalks. Several larvæ were kept alive indoors for months without pupation. It is believed that the pupal stage of this species does not begin until midsummer. The *Phalonia* caterpillars were found usually about half way between the base of the plant stalk and its apex.

In a shallow depression similar to that of *Phalonia* was found a single larva of the genus *Pyrausta*, the group to which belongs the destructive European corn-borer, *Pyrausta nubilalis*. No life history of an insect of this genus has ever been described from *Lactuca*. As the single specimen found had to be killed for identification it was not possible to obtain an adult for determination of species.

On May 9 an examination of *Lactuca* stalks, all obtained in the same locality, yielded three larvæ of the family Noctuidæ. Only one larva was found in a stalk, and all were apparently actively boring in the pith, each being surrounded by an accumulation of frass. The genus could not be determined without rearing the adults, but it is believed to be closely associated with the cutworms, although the boring habit is not characteristic of this group.

Diptera

Well down near the base of several stalks of *Lactuca* were found adult insects of the family Mycetophilidae, genus *Exechia*. Usually only single specimens were found, but in one stalk a group of four were packed closely together. As the first adult

was found on March 13 it is probable that the insects were hibernating in that stage.

The only other representative of this order was a specimen of *Agromyza virens* Loew which was found in the pupal stage in material brought indoors on March 22, and which later emerged.

Hymenoptera

In material collected on May 9, a few inches from the apex of a dried stalk was found an adult female carpenter-bee, *Ceratina dupla* Say. Insects of this genus commonly build nests, provisioned with pollen and nectar, in the stems of sumac and other plants, so it was not unusual to find this female in such a situation.

A number of specimens of *Scambus scriptifrons* (Cresson) were found pupating in depressions in the pith of several stalks. Adults were obtained from two of these pupæ.

By far the most numerous members of the *Lactuca* population were insects belonging to the superfamilies Cynipoidea and Chalcidoidea. Because of the fact that this study was carried on during the part of the year when no fresh plant material was available, the life histories and relationships of the species found could not be carried through.

Of the Cynipoidea only one species was found—*Aulacidea podagrae* (Bassett). This species belongs to the tribe Aulacini which contains the most primitive members of the family Cynipidae. Three species of *Aulacidea* have been reported from *Lactuca* in this country. *A. podagrae* has been described from *Quercus* as well as from *Lactuca*. The normal time of emergence of this species is mid-June. From *Lactuca* stalks brought indoors on February 20 adults first emerged on March 18. The cynipids were found to be much slower in pupating than the chalcids.

The galls caused by *A. podagrae* take the form of rounded swellings at the leaf nodes of the host plant, or they occur as small hollow chambers scattered throughout the pith with no external evidence of their existence.

Kinsey says of this species: "It may be that the state of the plant at the time the insect's egg is laid in it, or the physiological

nature of the particular plant, due to its special environment, determines the extent of the hypertrophy. In either event it seems that the gall-producing powers of the insect are not developed enough to insure the formation of a gall except under the most favorable circumstances, although other Cynipidæ, whenever they produce a gall at all, apparently always produce galls of a uniform pattern and of the same degree of complexity."

The galls were found to be fairly definite in distribution in the various stems examined. In no plants were galls found to be present in the roots or in the basal foot of stem. In the second and third feet only occasional galls were present, while from the fourth foot upward to the beginning of the flower panicle they were extremely abundant. A count of the larvæ found in one inch of stem which appeared to have a maximum infestation yielded a total of 68. Others more moderately infested were found to have 20 larvæ per inch. This count included both cynipids and chalcids. On May 5 an examination was made of three 6-inch sections of stem, all much swollen by galls. These sections of stem had been brought indoors in October, and had been kept in a closed glass jar throughout the winter. A count of the population which had emerged from these galls gave 245 adults of *Aulacideia podagrae*, and 14 adults of *Ormyrus ventricosus*. A few pupæ were also found.

These figures give only a general idea of the stupendous numbers of these insects which must emerge from one small patch of *Lactuca* during a single season. It is indeed fortunate that these two groups act as checks upon each other. If the cynipids begin to increase greatly, the parasitic chalcids increase also, and feed upon them; if the chalcids become too numerous the food supply becomes insufficient and their numbers decrease. So is the balance of nature accomplished.

In the group Chalcidoidea three distinct species were found. Very few parasites emerged from the enlarged stem galls, most of them coming from the small chambers in the pith of normal-sized stalks. Whether some of these species are true gall-makers themselves is uncertain. From some stalks nearly the whole emerging population consisted of chalcids.

The first chalcid to emerge, and the species which proved most numerous in all the material examined, was *Ormyrus ventricosus*

Ashmead, a brilliant metallic green insect about 4 mm. in length. On March 8 a large number of these newly emerged chalcids was examined from material brought in February 15, and all were found to be males. Two days later another emerging group was made up wholly of females of the same species. This order of emergence is said to be characteristic of most chalcids.

The second group to emerge was made up of individuals of the species *Eurytoma tylodermatis* Ashmead, the first specimens being noted on March 13 from stalks brought in February 20. These eurytomids were easily distinguished from the previous group by their lack of metallic coloring and by their shining black abdomens. In the male the abdomen is small and distinctly pediceled, and each antennal segment is constricted at its apex and provided with a conspicuous whorl of long hairs. The female has a less distinct pedicel, a larger abdomen, and lacks the antennal constrictions and whorls of hairs.

Of the third species, *Eupelminus coleopterophagus* Girault, only one specimen was found. This was an apterous form about 4 mm. in length.

This very brief survey of the insect population of *Lactuca* stems has thus revealed representatives of five different orders, totaling thirteen species, of which at least five are permanent residents in the stalks of the host plant.

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TWO NEW LOCALITIES FOR *PARNASSIUS APOLLO* IN ASIA MINOR

BY MARTIN HOLTZ

BERLIN, GERMANY

This year the well-known entomologist and cavern-searcher, Mr. L. Weirather-Innsbruck (Austria, Postfach 109) on his expedition to the Pisidian Taurus has discovered two new localities for *Parnassius apollo* in Asia Minor.

One of the localities is situated in the sterile country of Anamas (northwest of the lake of Bey-Shéhîr and south of the Sultan Dagħ next Ak-Shéhîr). The other locality is in the north of the high mountains in the Ovagyk-group (northeast of Adalia). The scientific determination of this race which is close to *anatolicus* Pgst., has not been settled exactly. It will be necessary to compare all the known localities on a map showing the zoogeographical distribution of *P. apollo* in Asia-Anterior. That such did not exist until now is regretted by the collector.

Note: According to a recent communication from Mr. Holtz, the new race will be described by Mr. Eisner in "Parnassiana." —Ed.

BOOK NOTICE

Blatchleyana. A List of the Published Writings of W. S. Blatchley, A.B., A.M., LL.D., of Indianapolis, Indiana, and Dunedin, Florida. Together with a Chronology of his Life: The Fixation of Types and New Genera and Species Described by Him, etc., etc. The Nature Publishing Co., Indianapolis, 1930.

The title as given above tells what Dr. Blatchley, always practical and helpful, has to say in seventy-seven pages of his activities from the time he was born in Connecticut in 1859 to the present. He should feel justly proud of the record, for but few have been so helpful to their fellow naturalists as has been Dr. Blatchley.

Blatchleyana is a document of unusual interest for, in the "Chronology" with which it begins, it is an autobiography tracing the early struggles of the author to gain an education, meanwhile supporting himself by peddling notions on foot, and the later triumphs which culminate in the well-deserved honor of the degree of LL.D.

In the footnotes of the lists of species described by him, Dr. Blatchley has compelled the taxonomist to take notice of the publication by rising to their defence and combating the synonymy which has in some cases been proposed. His literary taste is exemplified on numerous pages by quotations from his own and other writings, and his strong personality is well shown by the two portraits.

The lengthy bibliography includes numerous titles, such as "Gold and Diamonds in Indiana" and the "Petroleum Industry," papers published from 1894 to 1911, during the time Dr. Blatchley was Indiana's State Geologist, but he has confided to us that his heart and mind during all that time leaned most strongly toward his beloved insects. The authors of this notice are gratified that they have had the privilege of knowing Dr. Blatchley intimately, of sympathizing with him, and they are pleased to find in the record of his life that on three different occasions during the preparation of his useful manuals on the insects of the eastern United States, that he has visited their homes and collections on Staten Island.—Wm. T. Davis, Charles W. Leng.

INDEX TO NAMES OF INSECTS AND PLANTS IN VOLUME XXXVIII

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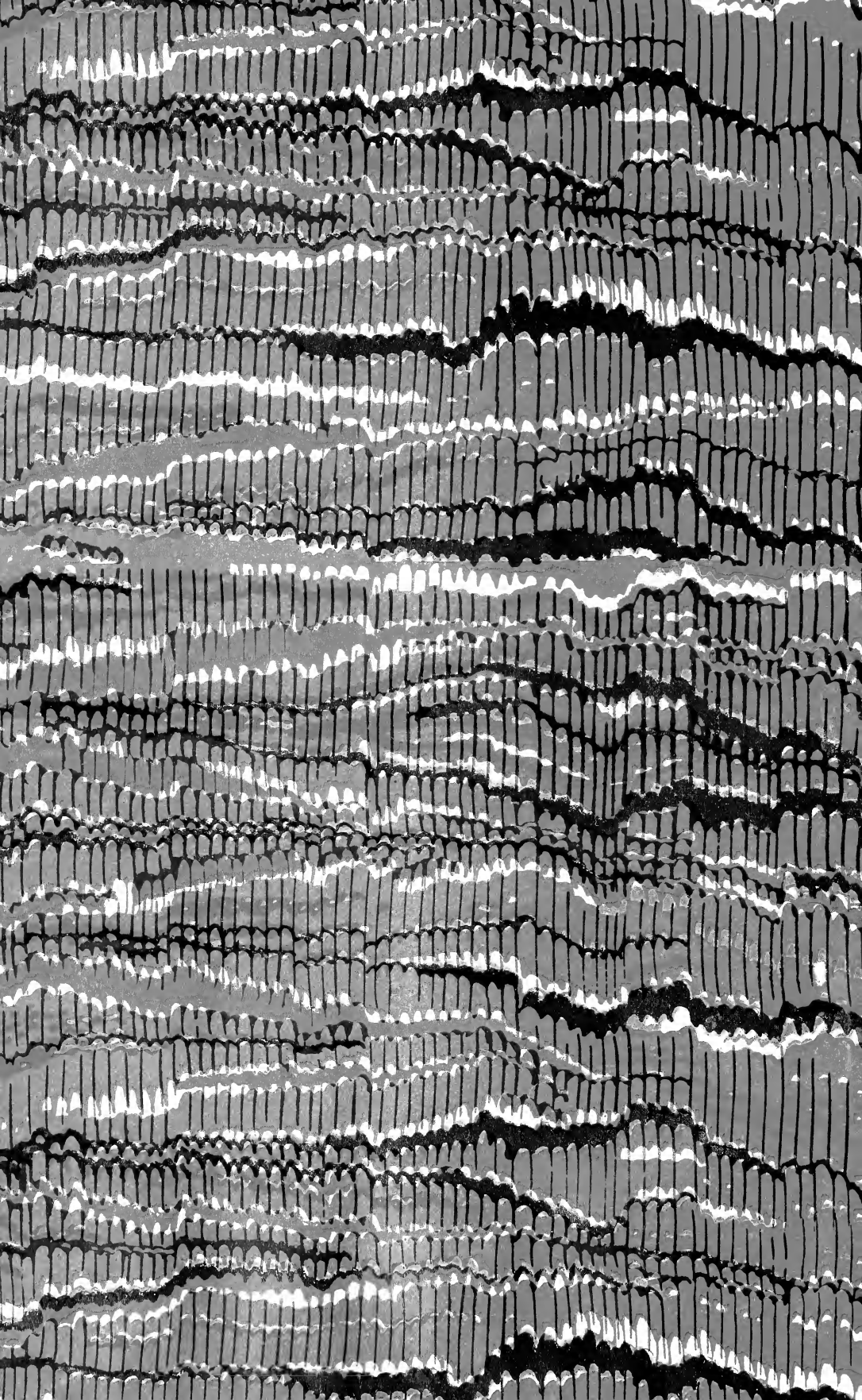
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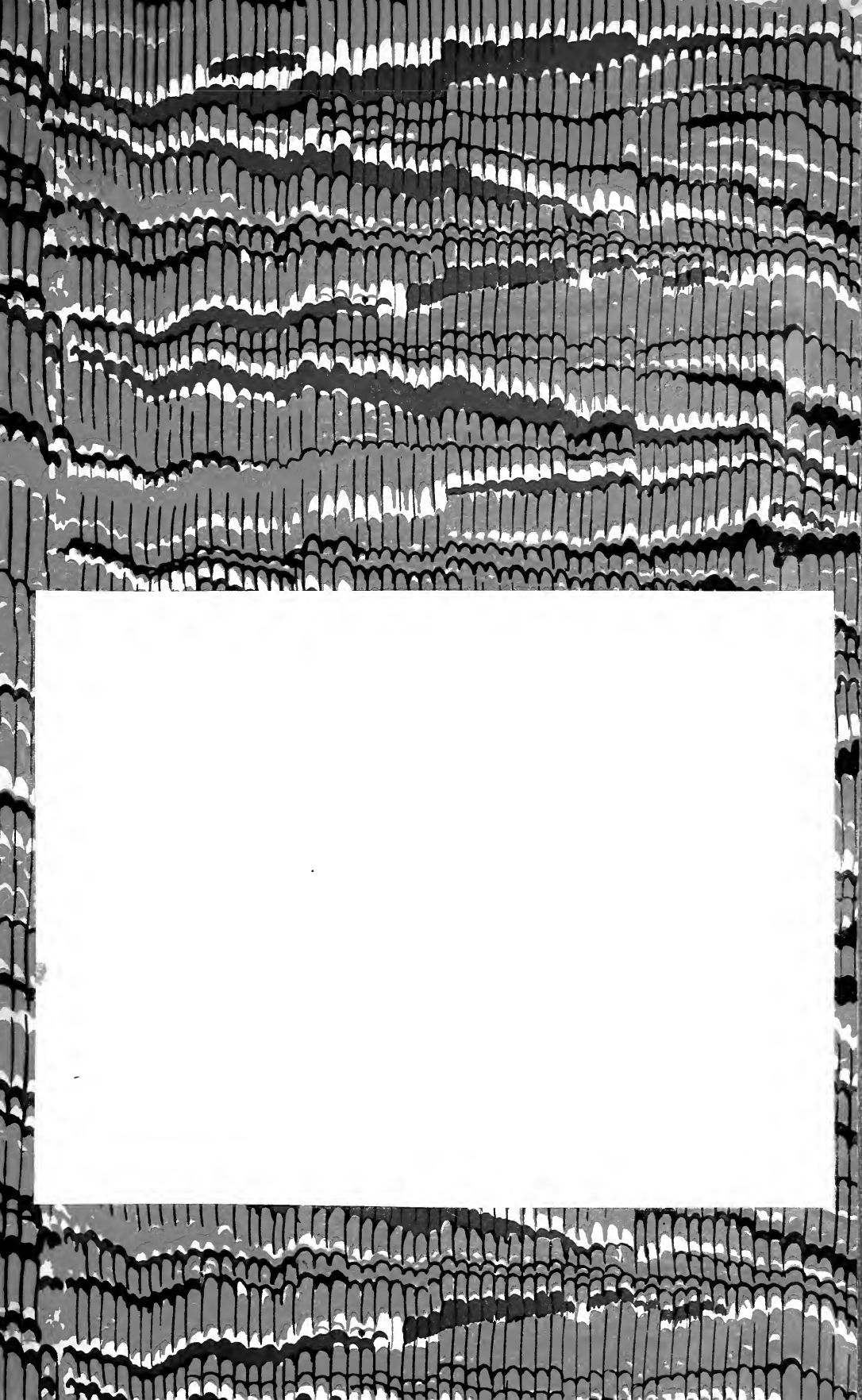
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